Exhibit 4

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Arndt Mueller	
U.S. Patent No.:	8,320,566	Attorney Docket No.: 45035-0027IP1
Issue Date:	November 27, 2012	
Appl. Serial No.:	12/580,227	
Filing Date:	October 15, 2009	
Title:	METHOD AND APPARATUS FOR PERFORMING CONSTELLATION SCRAMBLING IN A MULTIMEDIA HOME NETWORK	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 8,320,566 PURSUANT TO 35 U.S.C. §§311-319, 37 C.F.R. §42

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DISH-1013	U.S. Patent 8,526,412 to Vijayan et al ("Vijayan")

DISH-1014	"Pseudo noise sequences for engineers" by R.N. Mutagi ("Mutagi")
DISH-1015	Wei-Chia Ting, Low-Complexity Inner Receiver Design for IEEE 802.16 OFDMA Systems (July 2007) (Ph.D. thesis, National Chiao-Tung University) ("Ting")
DISH-1016	U.S. Patent Application Publication No. 2008/0298241 A1 to Yitshak Ohana et al. ("Ohana")
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DISH-1020	LegalMetric Time to Trial Report, Central District of California, Patent Cases (Jan. 2021-Nov. 2023)
DISH-1021	Order Granting Stipulation Setting Claim Construction Schedule, from Entropic Communications, LLC v. DISH Network Corporation et al., Case 2:23-cv-01043, ECF No. 1 (C.D. Cal. Aug. 21, 2023)
DISH-1022	U.S. Patent Application Publication No. 2007/0133386 to Kim et al. ("Kim")
DISH-1023	U.S. Patent 7,054,296 to Sorrells et al. ("Sorrells")
DISH-1024	U.S. Patent Application Publication No. 2005/0287964 to Tanaka et al. ("Tanaka")

DISH-1025	U.S. Patent Application Publication No. 2008/0076432 to Senarath et al. ("Senarath")
DISH-1026	Stephen Boyd, "Multitone Signals with Low Crest Factor," IEEE Transactions on Circuits and Systems, Vol. Cas-33 No. 10, Oct. 1986 ("Boyd")
DISH-1027	Robert Chang, "A Theoretical Study of Performance of an Orthogoal Multiplexing Data Transmission Scheme," IEEE Transactions on Communication Technology, Vol. Com.-16, No. 4, Aug. 1968 ("Chang")
DISH-1028	Leon Couch, ed., Modern Communication Systems, Principles and Applications (1995) ("Couch")
DISH-1029	M.L. Doelz, Binary Data Transmission Techniques for Linear Systems, PROCEEDINGS OF THE IRE, 656, May 1956 ("Doelz")
DISH-1030	U.S. Patent No. 6,657,949 to Jones, IV et al. ("Jones")
DISH-1031	U.S. Patent No. 7,363,038 to Kim et al. ("Kim '038")
DISH-1032	Didem Kivanc et al., Subcarrier allocation and power control for OFDMA. Conference Record of the Thirty-Fourth Asilomar Conference on Signals, Systems and Computers (Cat. No.00CH37154), 1, 147-151 vol.1. (2000) ("Kivanc")
DISH-1033	Anton Monk et al., The Multimedia Over Coax Alliance, Proceedings of the IEEE, Vol. 101, No. 11, Nov. 2013 ("Monk")

CHALLENGED CLAIMS[1]

Claim 1	
[1pre]	A method for communications transmission using orthogonal frequency division multiple access on a network comprising:
[1a]	a) providing a plurality of transmitting network devices with a set of available subcarriers for orthogonal frequency division multiple access;
[1b]	b) providing a corresponding element of a pseudorandom noise sequence for each subcarrier of the set of available subcarriers;
[1c]	c) allocating a subset of the set of available subcarriers to each of the transmitting network devices;
[1d]	d) [i] a transmitting network device of the plurality of devices [ii] mapping a packet onto a plurality of used subcarriers of its allocated subset of available subcarriers, wherein the step of [iii] mapping the packet comprises mapping the packet onto a plurality of quadrature amplitude modulated symbols to be transmitted on the used subcarriers;

[1] All elements and subpart lettering added.

[1e]	e) the transmitting network device [i] performing a predetermined transformation on a quadrature amplitude modulated symbol [ii] using the element of the pseudorandom noise sequence corresponding to the used subcarrier;
[1f]	f) the transmitting network device transmitting the transformed symbol to a receiving network device.

Claim 2	
[2pre]	The method of claim 1, wherein the steps of providing a corresponding element of a pseudorandom noise sequence and performing a predetermined transformation comprise:
[2a]	a) the transmitting network device [i] receiving an initial pseudorandom noise sequence element from a pseudorandom noise sequence generator, [ii] the initial pseudorandom noise sequence element corresponding to a first available subcarrier and [iii] transforming the symbol to be transmitted on the first available subcarrier if the first available subcarrier is a used subcarrier; and

[2b]	b) the transmitting network device advancing the pseudorandom noise generator to receive a next element of the pseudorandom noise sequence corresponding to a next available subcarrier and transforming the symbol to be transmitted on the next available subcarrier if the next available subcarrier is a used subcarrier.

Claim 3	
[3]	The method of claim 2, wherein the step of the transmitting network device advancing the pseudorandom noise generator is repeated until a symbol to be transmitted on a last used subcarrier is transformed.

Claim 4	
[4]	The method of claim 1, wherein the pseudorandom noise sequence comprises a PN-15 sequence.

Claim 5	
[5]	The method of claim 4, wherein the step of performing the predetermined transformation comprises rotating the quadrature amplitude modulated symbol by 180° if the element of the pseudorandom noise sequence is a ‘1’ and not modifying the quadrature amplitude modulated symbol if the element of the pseudorandom noise sequence is a ‘0’.

Claim 6	
[6]	The method of claim 4, wherein the receiving network device comprises a network coordinator and wherein the packet comprises a resource reservation request packet.

Claim 12	
[12]	The method of claim 4, wherein the method is performed by a network coordinator and wherein first and second scrambled orthogonal frequency division modulation symbols are contained in a resource reservation request packet.

I. INTRODUCTION

Orthogonal frequency division multiple access ("OFDMA") is a common modulation scheme because it supports high-speed, wireless data transfer on networks having multiple users. Standards-setting-organizations (e.g., IEEE) selected OFDMA for WiMAX (IEEE802.16a) and 4G LTE. DISH-1004, ¶¶37-38. Concurrently, wireless engineers were developing methods to address issues afflicting modulation schemes, including OFDMA, like signal interference between multiple interconnected devices. *Id.*

Wireless engineers also knew that OFDMA systems suffered from interference due to power concentration, known as the peak-to-average power ratio ("PAR"), across different OFDMA subcarriers. *Id.*, ¶39. The engineers developed solutions to reduce PAR interference, like using pseudorandom scrambling to even-out power concentration across an aggregated OFDMA waveform. *Id.*

Claim 1 of the '566 patent is directed to an OFDMA network aiming to lower interference between devices by using the well-known technique of modulating the multiplexed signal with a pseudorandom noise sequence. Dependent claims 2-6 and 12 simply add other known, disparate concepts onto claim 1.

Ultimately, Hayashino and Tzannes show that using the claimed pseudorandom technique was known and obvious when used in OFDMA, and

Mutagi, Ting, and Ohana show that the '566 patent's dependent claims merely stack known concepts onto claim 1. Thus, because the Challenged Claims would have been obvious, the Board should institute IPR and cancel them.

II. REQUIREMENTS FOR IPR

A. Grounds for Standing

DISH Network L.L.C., DISH Network Corporation, Dish Network Service L.L.C., and Dish Network California Service Corporation (collectively, "DISH") certify that the '566 patent is available for IPR and DISH is not barred or estopped from requesting review. This Petition is filed within one year of service of a complaint against DISH in the U.S. District Court for the Central District of California ("District Court"). *See* DISH-1002; DISH-1003.

B. Challenge and Relief Requested

This Petition demonstrates a reasonable likelihood of prevailing as to at least one Challenged Claim. Petitioner requests IPR institution and cancellation of all Challenged Claims on the grounds identified below. Dr. Tim Williams's expert declaration (DISH-1004) provides supplemental explanation and support.

Ground	Challenged Claims	Basis
1A	1-3	§103: Cleveland-Hayashino
1B	4	§103: Cleveland-Hayashino, in view of Mutagi

Ground	Challenged Claims	Basis
1C	5	§103: Cleveland-Hayashino, in view of Mutagi and Ting
1D	6, 12	§103: Cleveland-Hayashino, in view of Mutagi and Ohana
2A	1-3	§103: Scheim-Tzannes
2B	4	§103: Scheim-Tzannes, in view of Mutagi
2C	5	§103: Scheim-Tzannes, in view of Mutagi and Ting
2D	6, 12	§103: Scheim-Tzannes, in view of Mutagi and Ohana

Each reference pre-dates 2008-10-16 ("Critical Date"), which is the earliest possible date to which the '566 patent claims priority.[2]

Reference	Prior Art Date	Basis (at least under)
Cleveland	2007-02-5 (filed) 2006-11-13 (provisional filed)	§102(a), (e)
Hayashino	1995-12-14 (filed)	§102(a), (b), (e)
Mutagi	1996-04-30 (published)	§102(b)
Ting	2007-07-31 (published)	§102(b)

[2] Petitioner does not concede that the Challenged Claims are entitled to the claimed priority.

Reference	Prior Art Date	Basis (at least under)
Ohana	2008-03-03 (filed) 2007-05-21 (provisional filed)	§102(a), (e)
Scheim	2008-03-20 (filed) 2007-03-22 (provisional filed)	§102(a), (e)
Tzannes	2000-11-09 (filed)	§102(a), (b), (e)

The Munford Declaration confirms Mutagi and Ting were publicly available before the critical date. *See* DISH-1018, ¶¶6-15.

C. Claim Construction

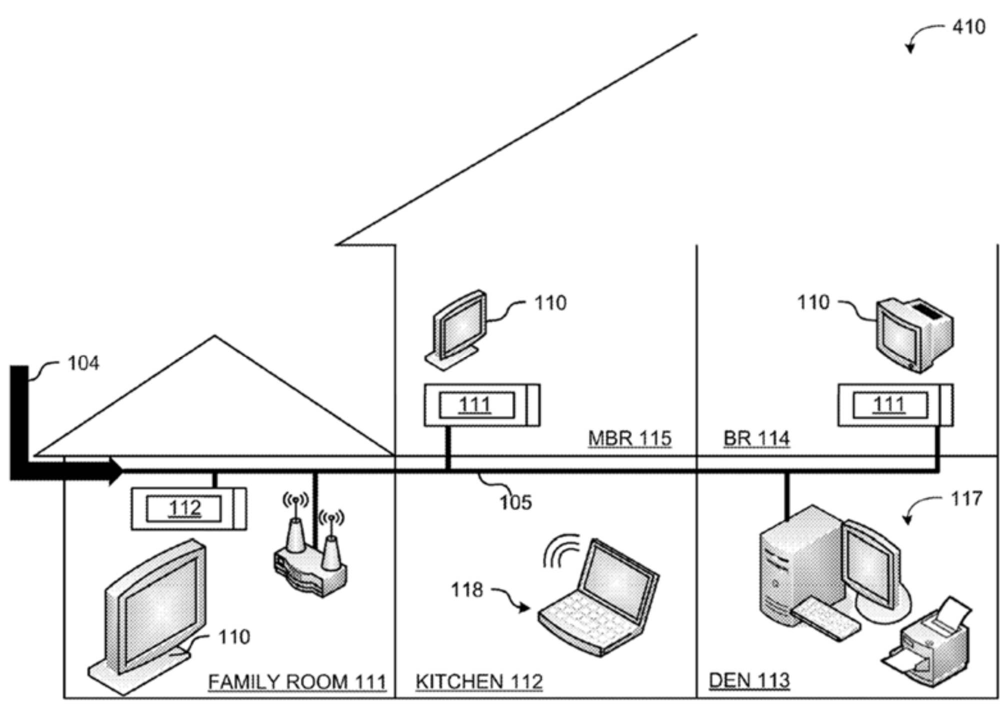
Because the Challenged Claims are obvious under any reasonable interpretation, no express constructions are required here. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) ("claim terms need only be construed to resolve a controversy"). Petitioner reserves the right to address any construction proposed by Patent Owner or the Board. Petitioner also reserves the right to pursue constructions in district court that are necessary to decide matters of infringement and §112 validity. Petitioner does not concede that the Challenged Claims satisfy patent statutory requirements, including §112.

III. THE '566 PATENT

A. Summary

The '566 patent relates to utilizing OFDMA data transmission techniques in wired or wireless networks. DISH-1001, Abstract, 10:66-11:4; DISH-1004, ¶29.

The ’566 patent explains that “communication networks are now commonplace in many home and office environments” and utilize components like “coaxial cable previously installed in households for cable or satellite TV service.” *Id.*, 1:32-33, 1:66-67; DISH-1004, ¶¶30-31. The Multimedia over Coax Alliance (“MoCA”) consortium addressed “the growing demand for a digital home networking market” by developing a “technical standard … for distributing digital entertainment over the available bandwidth” on those coaxial cable networks. *Id.*, 1:59-66. Accordingly, an “initial MoCA standard was approved in February 2006.” *Id.*, 1:66-67. Below, Figure 1 depicts “examples of equipment and other electronic devices or nodes that might be found in a typical home-networking environment, such as a network defined by MoCA.” *Id.*, 3:60-65.



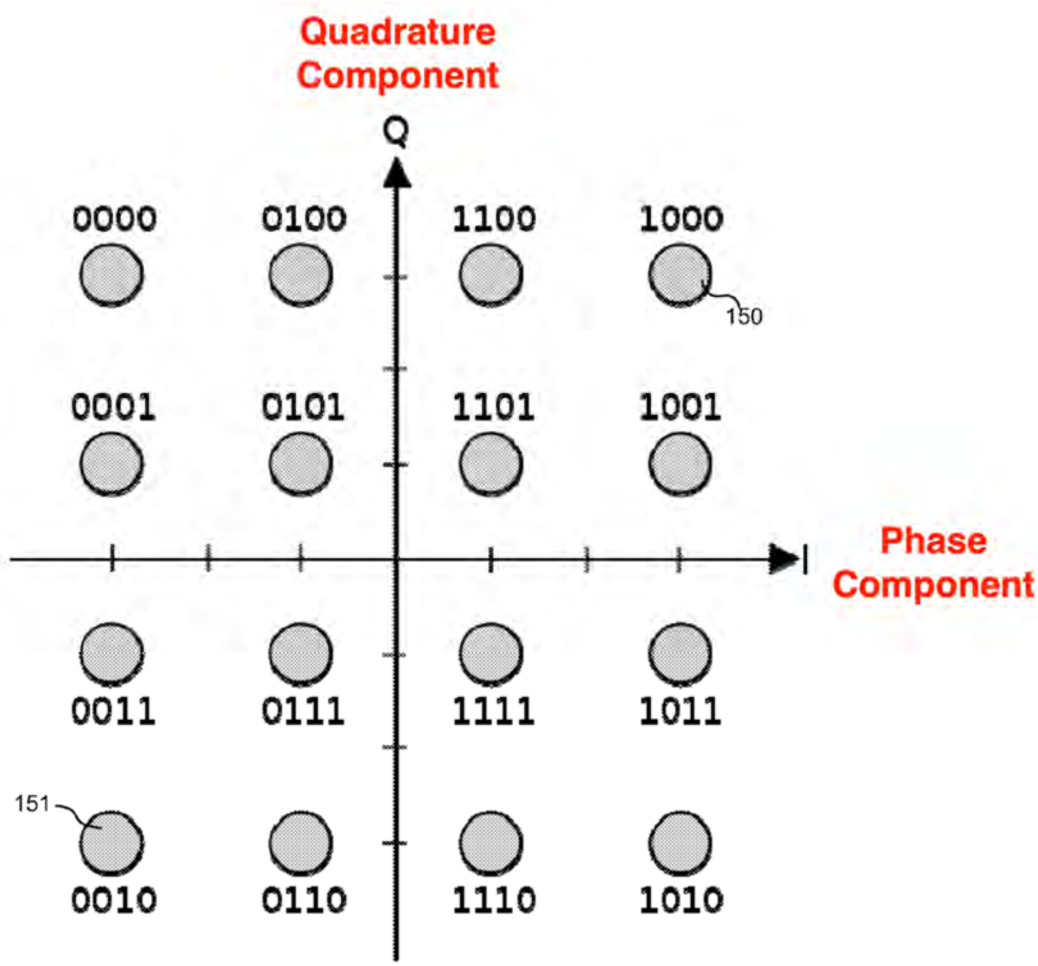
’566 PATENT, FIG. 1

The ’566 patent explains that “[a] MoCA network includes a plurality of client nodes” like TVs, set-top boxes, and computers “configured with a communication device that allows these devices to operate as a client node on the MoCA network.” *Id.*, FIG. 1, 4:30-35; DISH-1004, ¶33. During setup “one of the client nodes is automatically selected to be a network coordinator (NC).” *Id.*, 4:35-37. The NC “allocate[s] network bandwidth” within the system by “schedul[ing] times during which communication occurs[.]” *Id.*, 4:35-39. The NC performs these scheduling duties by “communicat[ing] the schedule to each client node in ‘Media Access Packets’ (MAPs)” and allowing “network devices to transmit a ‘Reservation Request’ (RR) … for a certain amount of bandwidth at a certain time.” *Id.*, 4:40-46. “The required time to receive these RRs grows with the size of the network.” *Id.*, 4:46-48.

In such networks, “physical layer (PHY) packets are transmitted using orthogonal frequency division multiplexing (OFDM).” *Id.*, 4:6-8; DISH-1004, ¶34.[3] OFDM modulates data “onto a plurality of frequency subcarriers.” *Id.*, 4:9-10. OFDMA makes “further subsets of the available subcarriers” available to

[3] OFDMA is an extension of OFDM rather than a new technique. *See* DISH-1004, ¶35. Further, Dr. Williams provides additional background on OFDMA and QAM. *Id.*, ¶¶36-46.

network nodes. *Id.*, 5:6-8. In OFDM, subcarriers are "modulated using quadrature amplitude modulation (QAM)." *Id.*, 4:9-11, 5:53-58. "The two subcarriers are termed the quadrature (Q) component and the in phase (I) component," which can be represented visually as a "constellation diagram … with Q and I as axes of a graph." *Id.*, 4:12-21. Figure 2 illustrates a 16-QAM coding scheme. *Id.*, FIG. 2.



'566 PATENT, FIG. 2[4]

[4] All annotations shown in color.

The ’566 patent describes configuring the transmitting devices “to perform constellation scrambling on the [QAM modulated] symbols they will be transmitting using a predetermined scrambling sequence,” e.g., a pseudorandom sequence. *Id.*, 2:23-25. The scrambling operation uses an element of the pseudorandom sequence to scramble QAM symbols on active subcarriers, e.g., by multiplying QAM symbols of a particular sub-carrier with an element from the pseudorandom sequence, and advancing the sequence and subcarriers through the OFDM symbols until the message is scrambled. *Id.*, 6:22-66; DISH-1004, ¶¶47-50. The ’566 patent discloses a generic “pseudorandom sequence generator” providing a conventional 15th order pseudorandom noise sequence. *Id.*, 8:55-9:9. The pseudorandom sequence generator provides the pseudorandom sequence elements for scrambling the QAM symbols. DISH-1001, 9:10-21.

B. Prosecution History

On 2009-10-15, Applicant filed the application that would issue as the ’566 patent. DISH-1005, 159, 190-96; *see also* DISH-1004, ¶¶51-67. The original 18 claims issued without substantive amendment.

On 2011-11-09, the Examiner entered a Non-Final Office Action rejecting all claims, including challenged claims 1-6 and 12. DISH-1005, 101. The Examiner found claims 1-3 and 5 obvious over Kim (DISH-1022) and Sorrells (DISH-1023). *Id.*, 105-115, 118-119 (finding Kim discloses an OFDMA network

and a PN-15 sequence, and Sorrells discloses mapping a packet onto QAM symbols and subcarriers, and rotating a symbol by 180°). The Examiner found claim 4 obvious over Kim and Sorrells, combined with Tanaka. *Id.*, 118 (finding Tanaka discloses using and that Sorrells discloses). Finally, the Examiner found claims 6 and 12 obvious over Kim, Sorrells, and Tanaka, combined with Senarath. *Id.*, 120-121 (finding Senarath discloses using resource reservation request packets and that OFDMA symbols are in a resource reservation packet).

In response, Applicant argued that Kim failed to disclose element [1e], a "transmitting network device performing a predetermined transformation on a quadrature amplitude modulated symbol using the element of the pseudorandom noise sequence corresponding to the used subcarrier." DISH-1005, 94-95. Applicant argued that Kim's pseudorandom noise sequence was used "to place particular pilot subcarriers within a set of subcarriers" whereas "Claim 1 recites using a pseudorandom sequence generator to assist in scrambling symbols to be transmitted on subcarriers of an OFDMA network." *Id.*, 95. Applicant further argued that none of Sorrells, Tanaka, or Senarath taught this missing element. *Id.*, 95-96. The Examiner subsequently allowed claims 1-6 and 12 without articulating reasons for allowance. *Id.*, 29.

C. Level of Ordinary Skill in the Art

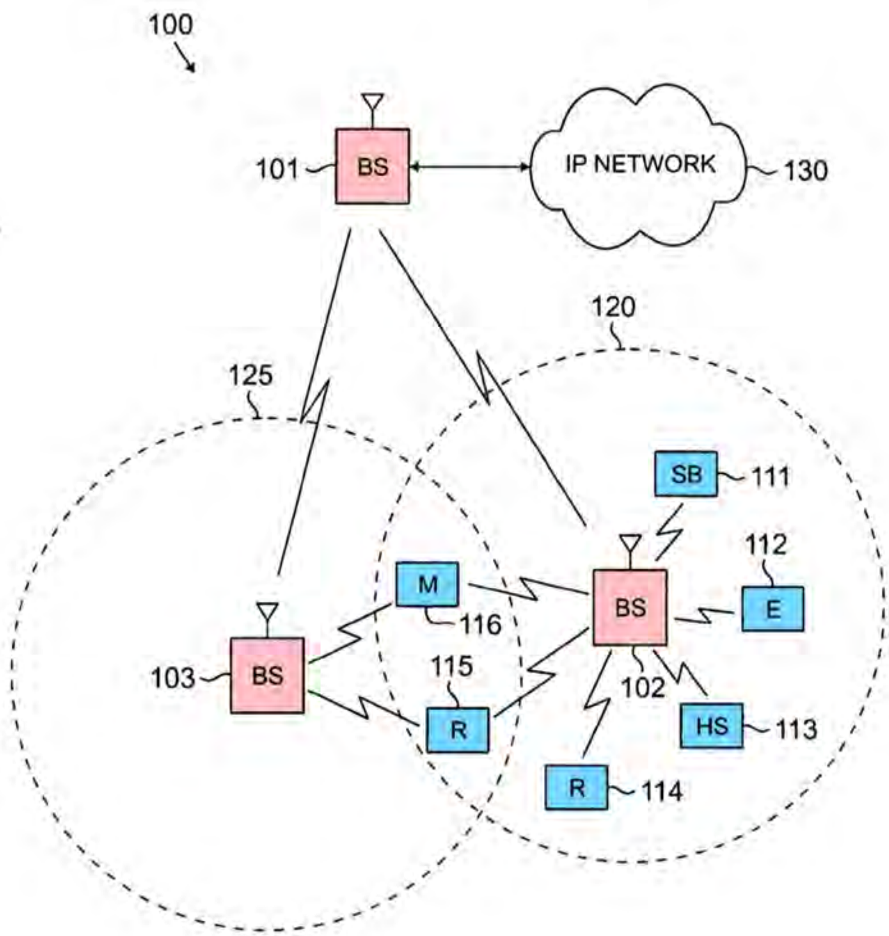
Regarding the '566 patent, a person of ordinary skill in the art ("POSITA") would have a degree in electrical engineering, computer engineering, or a related field and experience working in signal processing and/or communication systems/networks, e.g., a bachelor's and three or more years of experience; a master's and at least one year of experience; or a doctorate and some work experience. DISH-1004, ¶¶68-69, 1-13. Additional education could substitute for professional experience, or *vice versa*. *Id.*

IV. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1A: Cleveland and Hayashino render claims 1-3 obvious

1. Overview of Cleveland

Cleveland is directed to a wireless network that uses OFDMA. DISH-1006, Abstract; DISH-1004, ¶¶70-76. Cleveland's disclosure "may be used in any suitable wireless communication system," including WiMAX, which is one type of network that uses OFDMA. *Id.*, ¶¶5, 81; DISH-1004, ¶70. As shown below, Cleveland describes an exemplary OFDMA network having multiple base stations (red) and multiple subscriber stations (blue). DISH-1006, ¶¶25-35. Cleveland's subscriber stations can be any mobile device, e.g., a "laptop [or] handheld device." *Id.*, ¶¶27, 31.



CLEVELAND, FIG. 1

Cleveland uses typical OFDMA equipment and applies particular bandwidth-allocation techniques. *See generally id.*, Abstract, ¶¶36-38 (disclosing conventional equipment), ¶¶7-9 (describing techniques). Cleveland's Figure 2 below depicts a typical OFDMA transmitter, and Figure 3 depicts a typical OFDMA receiver. DISH-1004, ¶¶71-73.

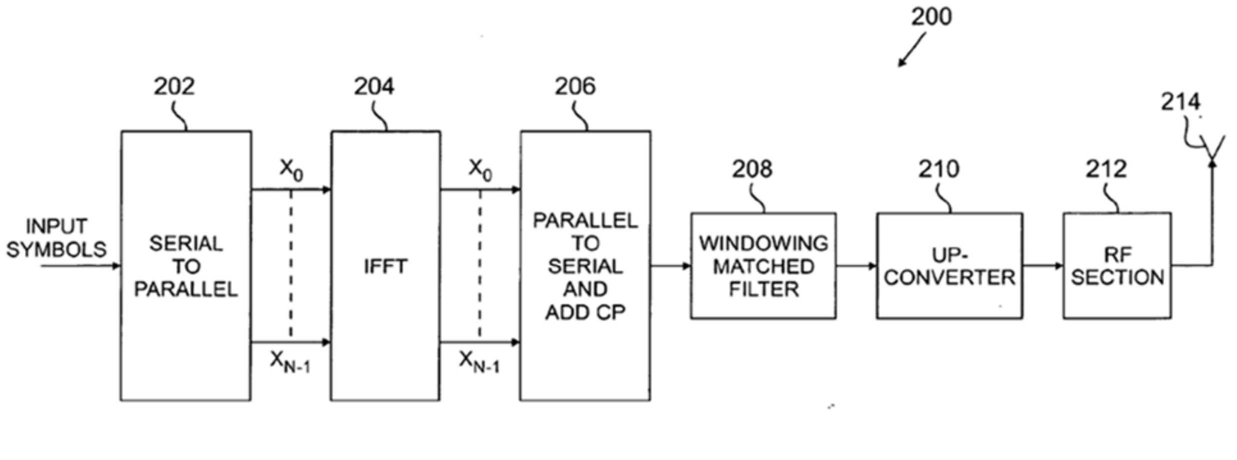


FIG. 2

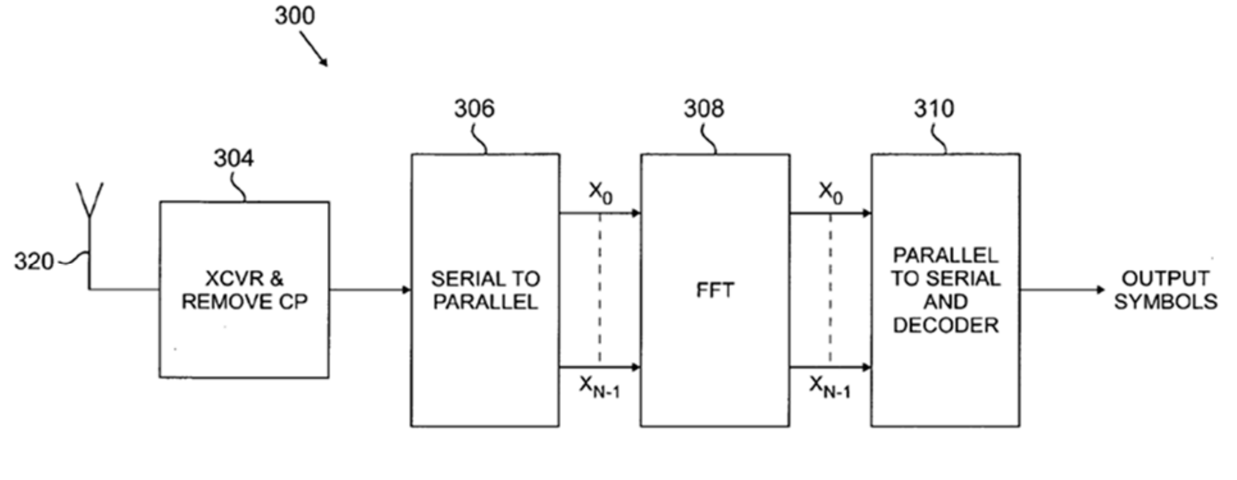


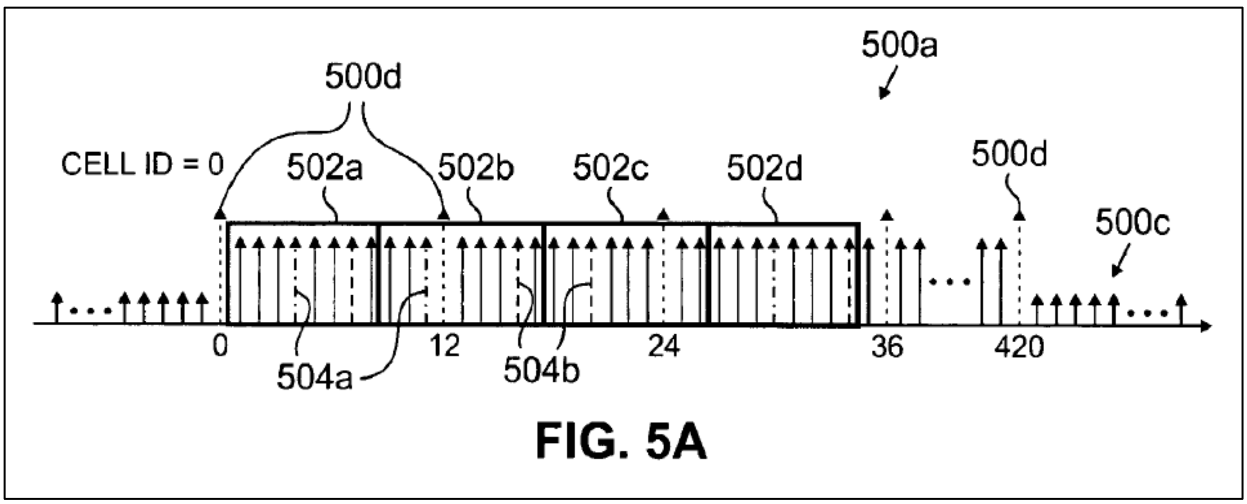
FIG. 3

CLEVELAND, FIGS. 2-3

While Cleveland describes the features of base stations, subscriber stations (e.g., cell phones), transmitters, and receivers, it does not explicitly state that each such station has a transmitter and a receiver. *See generally* DISH-1006, ¶¶25-40. But a POSITA would have understood that each base station and each subscriber station includes both a transmitter and a receiver so that they can communicate

together. DISH-1004, ¶73. Thus, Cleveland describes a typical OFDMA network having well-known structural components. *Id.*, ¶¶71-73.

As Cleveland acknowledges, known OFDMA networks suffered from intercell interference. Cleveland addresses this problem by selecting subcarriers with a pseudorandom sub-channel assignment algorithm. DISH-1006, ¶¶42-45. Cleveland's sub-channel assignment algorithm draws a subcarrier (e.g., 504a and 504b from FIG. 5A represent discrete subcarrier frequency bands) from a permutation group (502), a group of subcarriers. DISH-1006, ¶¶42-43, FIG. 5A; DISH-1004, ¶¶74-76.



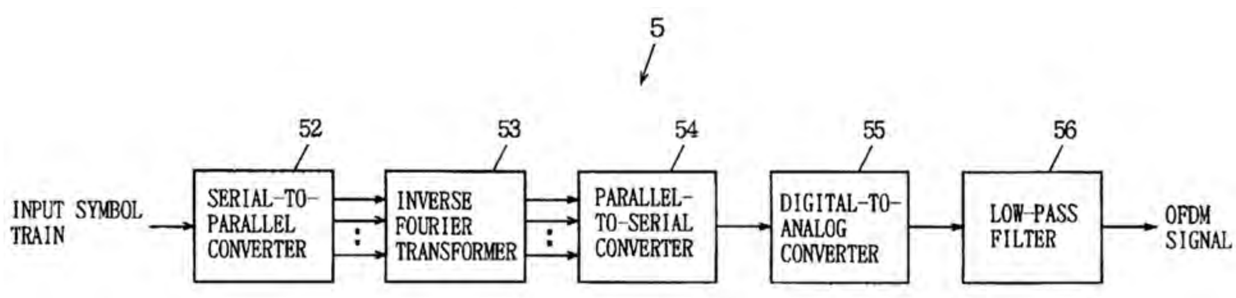
CLEVELAND, FIGURE 5A

Cleveland explains the subcarrier draw is "pseudorandom ... so that there is a high probability that the sub-carriers for a given sub-channel in a certain cell are different than sub-carriers for that same sub-channel in another cell." *Id.* The drawn subcarrier is then used in a new subchannel. *Id.* Cleveland notes that its

process is advantageous: "[t]his pseudorandom permutation provides an interference averaging effect further reducing the adverse effects of cell to cell interference." *Id.*

2. Overview of Hayashino

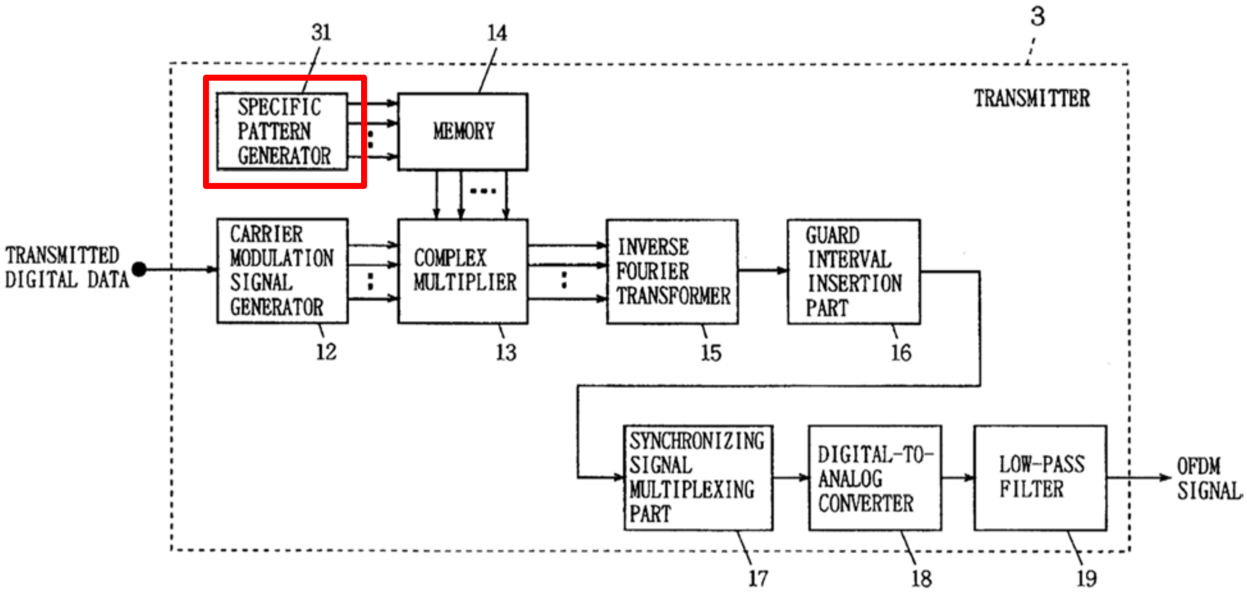
Hayashino discloses "an [OFDM] … method of transmitting data between a transmission side and a receiving side through a wire or wireless transmission path." DISH-1007, 1:7-12; DISH-1004, ¶¶77-79. Hayashino's "OFDM transmission system is adapted to divide coded data and sort the same into at least hundreds of carriers, for multiplexing and transmitting." *Id.*, 1:17-20. Referring to Figure 13, Hayashino teaches using "16 QAM" to modulate the Input Symbol Train processed by "conventional" OFDM transmitters. *Id.*, 1:38-55; DISH-1004, ¶78.



HAYASHINO, FIG. 13

Hayashino explains that a problem arises when "transmitting a sounding state or a multicolor picture [because] the carrier modulation signals tend to be completely in phase with each other in a digital modulation system such as … 16 QAM." *Id.*, 2:54-64. This scenario results in carrier nodes "concentrated to one

portion on the time axis… caus[ing] power concentration." *Id.*, 2:65-3:5. To address, Hayashino introduces pseudorandom noise to vary carrier phase using the OFDM transmitter shown below in Figure 9. DISH-1004, ¶78.



HAYASHINO, FIG. 9

Figure 9 features "specific pattern generator 31" which outputs "complex signal group D_0 having a predetermined specific pattern with signals which mutually vary in phase at random." *Id.*, 12:22-31. Hayashino discloses forming the complex signal group "by a pseudo-noise signal generator comprising a PN series pseudo-random signal generator for generating a pseudo-random signal … randomizing mutual phases of respective carrier modulation signals." *Id.*, 12:31-48. Hayashino teaches utilizing "16 QAM" as the modulation scheme, and applying reference "values in the range of zero to 2π." *Id.*, 12:50-54, 13:18-22.

The result is that "the OFDM signal … can be suppressed from power concentration" making it unnecessary to "increase the dynamic ranges of the transmitter." *Id.*, 13:20-25, 14:7-18.

3. Cleveland-Hayashino Combination

Cleveland-Hayashino uses Hayashino's pseudorandom-noise-sequence techniques on Cleveland's OFDMA equipment, resulting in an OFDMA network with lowered interference and eliminating the need for more expensive OFDMA equipment with a larger dynamic range. DISH-1004, ¶¶80-81. Cleveland and Hayashino are analogous art to the '566 patent because they are from the same field of endeavor—multiplex communication in networks using orthogonal techniques—and because both references are reasonably pertinent to the problems that the '566 patent's inventors faced, e.g., interference in OFDM/OFDMA systems. DISH-1004, ¶85; DISH-1001, 1:17-20; DISH-1006, ¶45; DISH-1007, 2:65-3:23.

As explained below, lowering the interference reduces the power concentration, which in turn reduces the peak-to-average power ratio ("PAR") and the dynamic range required by the OFDMA equipment.

Both Cleveland and Hayashino utilize orthogonal-frequency-division data-transmission techniques in communication networks. *Compare* DISH-1006, Abstract ("A system and method for synchronous spectrum sharing for use in a

wireless communication system based on … OFDM or … OFDMA signaling is disclosed.") *with* DISH-1007, 1:7-9 ("The present invention relates to an … OFDM transmission method."); DISH-1004, ¶82. Moreover, both are directed to reducing interference in OFDM-based networks. DISH-1004, ¶83; DISH-1006, ¶¶37, 42, 45; DISH-1007, 2:51-3:5, 13:7-22. Further, Hayashino teaches that using its pseudorandom technique avoids the need to increase the equipment's dynamic range, which allows engineers to use lower-priced equipment. DISH-1004, ¶84; DISH-1007, 13:23-26.

A POSITA seeking to improve Cleveland's base OFDMA system would have looked to references, like Hayashino, that teach methods to reduce multi-device interference and thus lowers power concentration. DISH-1004, ¶86. Similarly, a POSITA looking to simplify Cleveland's pseudorandom sub-channel assignment algorithm would have realized that the benefits of using Hayashino's approach in lieu of selecting each sub-channel in a pseudorandom manner as Cleveland does. This would have resulted in Cleveland's network introducing a pseudorandom element on each used subcarrier as Hayashino teaches, thus simplifying the process of determining which subchannels have been used and which are available for transmission. *Id.* Thus, a POSITA seeking to reduce the interference reported in an OFDMA network, like Cleveland's, would have looked

at other references, like Hayashino, that describe OFDM/OFDMA networks and reduced interference. *Id.*

For example, Hayashino explains that applying conventional OFDM data transmission techniques to signals lacking phase diversity resulted in carriers "concentrated to one portion on the time axis … caus[ing] power concentration." 2:51-3:5, FIG. 15. Hayashino teaches that introducing pseudo-random signals into the phase modulation process provides a more-uniform waveform, thereby suppressing the "power concentration." *Id.*, 13:8-22. A POSITA would have understood that power concentration suppression or averaging refers to a reduction in peak-to-average ratio ("PAR"). DISH-1004, ¶87.[5]

A POSITA would have understood that reducing PAR produces numerous benefits in Cleveland's network. DISH-1004, ¶88. For example, consistent with Hayashino's teachings, a POSITA would have realized that reducing PAR is beneficial because it lessens the probability of a signal clipping. This alone would have benefited Cleveland's network. And it would have enabled a POSITA to use lower-power and cheaper transmitters. *Id.*; DISH-1007, 3:24-35; 13:22-30. Because reducing PAR conserves power, it permits using transmitters/receivers

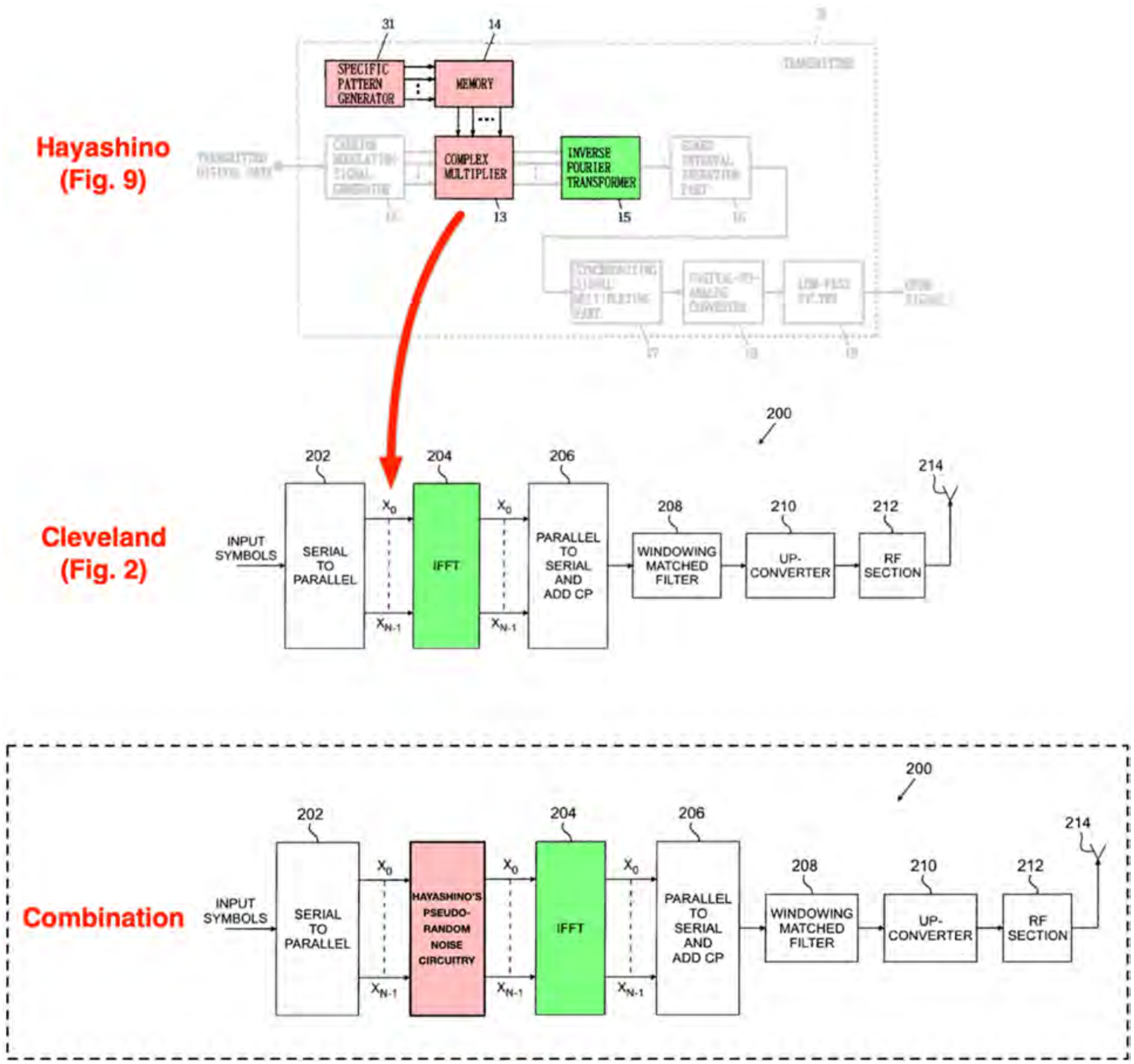
[5] PAR, in plain English, refers to how strong the signal is compared to background noise. DISH-1004, ¶87.

with lower power consumptions while maintaining the current range (or other network characteristics). DISH-1004, ¶89. A POSITA would have readily realized this improvement's benefit, particularly in Cleveland's network. DISH-1006, ¶31 (explaining a laptop can be a network device), ¶73 (describing a network of "battery-powered secondary nodes").

Further, in the field of OFDM/OFDMA modulation, a POSITA would have found implementing Hayashino's method in Cleveland's network a predictable and routine exercise. DISH-1004, ¶90. For example, both Cleveland and Hayashino discuss mapping parallel data streams into serial orthogonal phase (I or real) and quadrature (Q or imaginary) components. Cleveland utilizes "serial-to-parallel converter 202 [to] map[] each parallel data stream into I and Q modulation symbols." DISH-1006, ¶36. Hayashino likewise incorporates 16 QAM in conjunction with a complex multiplier to diversify the serialized phase (real) and quadrature (imaginary) modulation symbols. DISH-1007, 12:49-13:6, FIG. 10. DISH-1004, ¶90. To accomplish this, Hayashino also utilizes a "parallel-to-serial converter" that "converts the multiplex signal on the time axis, thereby forming a OFDM signal." DISH-1007, 2:7-9.

As shown below in the exemplary combination, the efficiency benefits, as well as the similarities across Cleveland's and Hayashino's teachings, would have

made their combination predictable to a POSITA. DISH-1004, ¶91; DISH-1006, FIG. 2; DISH-1007, FIG. 9.



HAYASHINO, FIG. 9; CLEVELAND, FIG. 2; COMBINATION

A POSITA would have had a reasonable expectation that the Cleveland-Hayashino combination had a foreseeable chance of success. DISH-1004, ¶92. Incorporating such circuitry is routine engineering and is well within a POSITA's

abilities. DISH-1004, ¶92. Further, as shown above, utilizing Hayashino's pseudorandom noise circuitry in Cleveland would not change Cleveland's principle of operation or require a substantial redesign of its elements. DISH-1004, ¶93. Indeed, Hayashino contemplates that "the reference complex signal group may alternatively be directly inputted in the inverse Fourier transformer 15" like Cleveland's IFFT block (204). *Id.*; DISH-1007, 14:1-6. Thus, a POSITA would have reasonably expected that applying Hayashino in Cleveland would reduce PAR, as Hayashino teaches. DISH-1004, ¶93.

In sum, a POSITA would have been motivated to reduce PAR in communications networks as it would reduce signal interference and thus enable use of lower-power and less-costly transmitters. A POSITA would have reasonably expected that applying Hayashino's teachings in an OFDMA network like Cleveland's would lower PAR because applying Hayashino represents using concepts from a known technique/network to improve a similar network, namely Cleveland. DISH-1004, ¶94.

4. Claim 1

[1pre] "A method for communications transmission using orthogonal frequency division multiple access on a network comprising:"

To the extent the preamble is limiting, Cleveland discloses [1pre], or renders it obvious in view of Hayashino. DISH-1004, ¶95-98.

Cleveland discloses "[a] system and method for synchronous spectrum sharing for use in a wireless communication system based on orthogonal frequency-division multiplexing (OFDM) or orthogonal frequency division multiple access (OFDMA) signaling." DISH-1006, Abstract; DISH-1004, ¶96.

Hayashino similarly discloses "an orthogonal frequency division multiplexing (hereinafter referred to as OFDM) transmission method … of transmitting data [(communications transmission)] between a transmission side and a receiving side through a wire or wireless transmission path with an orthogonal frequency division multiplex signal." DISH-1007, 1:7-13; DISH-1004, ¶97.

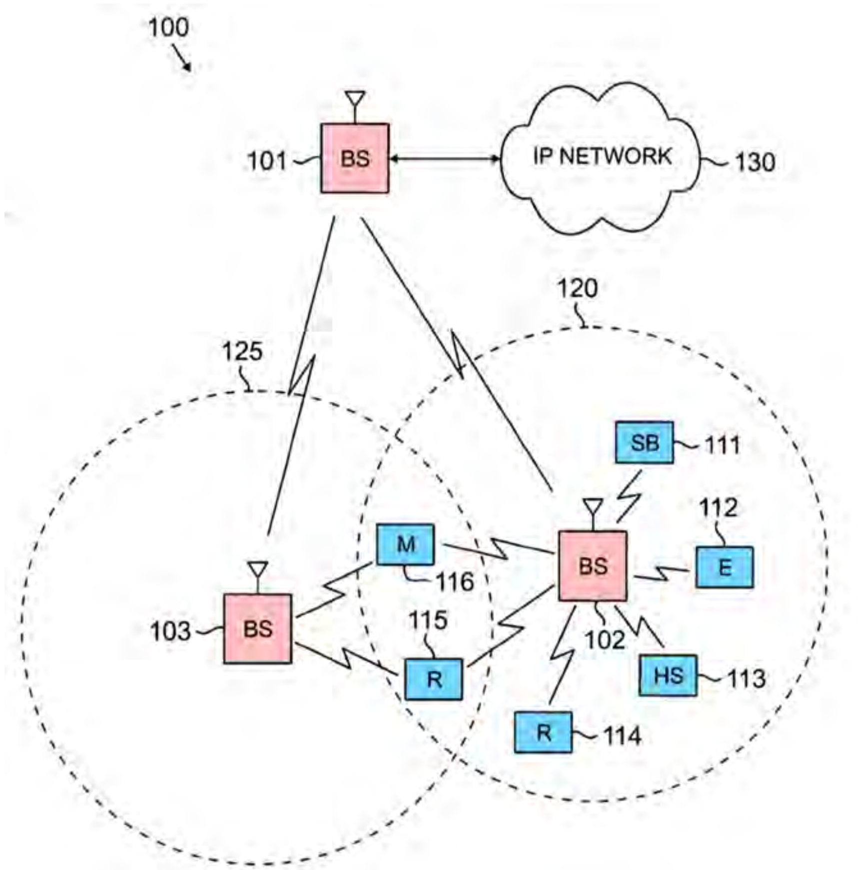
A POSITA would have also understood that Hayashino's OFDM concepts were applicable to Cleveland's OFDM/OFDMA networks. DISH-1004, ¶98. For example, Cleveland clarifies that its concepts can be used in OFDM and OFDMA networks and that contemporary networks use "OFDM and/or OFDMA techniques." *Id.*; DISH-1006, Abstract, ¶29, 36, 40, FIGS. 1, 2.

[1a] "a) providing a plurality of transmitting network devices with a set of available subcarriers for orthogonal frequency division multiple access"

A POSITA would have understood that Cleveland's base stations and subscriber stations disclose or render obvious "transmitting network devices" having a set of "available subcarriers" for OFDMA. DISH-1004, ¶¶99-106. For example, Cleveland discloses "synchronous spectrum sharing for use in a wireless

communication system based on orthogonal frequency-division multiplexing (OFDM) or orthogonal frequency division multiple access (OFDMA)." DISH-1006, Abstract; DISH-1004, ¶101. Cleveland's Figure 1 depicts a "plurality of transmitting network devices" in wireless network 100, which "includes base station (BS) 101, base station (BS) 102, and base station (BS) 103." BS 102 and 103 "communicate … with subscriber stations 111-116 using OFDM and/or OFDMA techniques." DISH-1006, ¶¶25, 27-29, FIG. 1; DISH-1004, ¶101.[6]

[6] Subscriber stations 111-116 also qualify as a plurality of transmitting devices. DISH-1004, ¶102. In Cleveland, as in many communications systems, both the base station and subscriber stations each transmit and receive data. *Id.* This makes sense—as an example, consider a cell phone network, where base stations and cell phones each transmit and receive data to facilitate a conversation.



CLEVELAND, FIG. 1

Cleveland's spectrum sharing—here, assigning subcarriers for OFDMA—includes a "secondary user node transmit[ting] data in a first one of usable sub-carriers identified in the subframe information." DISH-1006, ¶7; DISH-1004, ¶103.[7] As shown below in Figure 5A, Cleveland teaches achieving "sub-carrier

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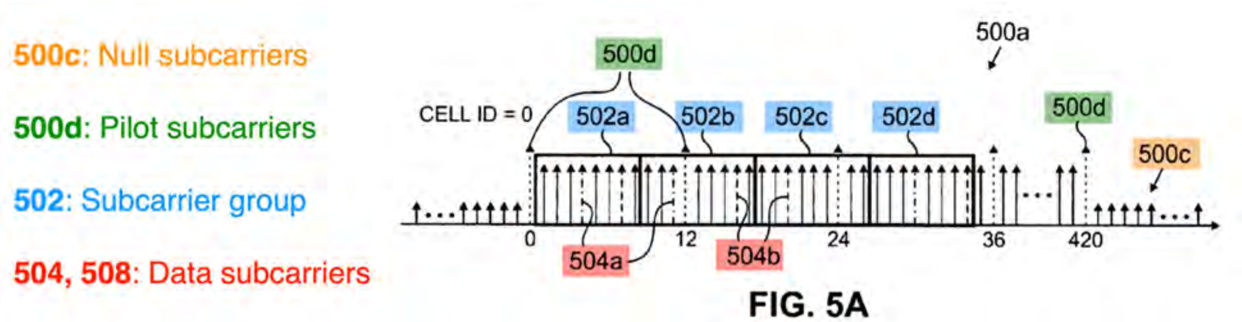
[7] In Cleveland, a "primary user node" means the nodes have priority access to spectrum. DISH-1004, ¶103; DISH-1006, ¶¶55-56 ("The term "secondary user" generally refers to a spectrum user who is not an owner of the spectrum but who

allocation[] 500a" through "a permutation process [that] draws a sub-carrier pseudo-randomly from permutation groups 502 [(e.g., 502a, 502b, 502c, 502d)] … so that there is a high probability that the sub-carriers for a given sub-channel in a certain cell are different than sub-carriers for that same sub-channel in another cell." DISH-1006, ¶¶41-43.



CLEVELAND, FIG. 5A[8]

Consistent with Cleveland, Hayashino discloses a transmitting network device in its network. DISH-1007, 3:39-55, FIG. 1. This further establishes that Cleveland-Hayashino renders obvious providing a plurality of transmitting network devices with subcarrier for OFDMA. DISH-1004, ¶104.

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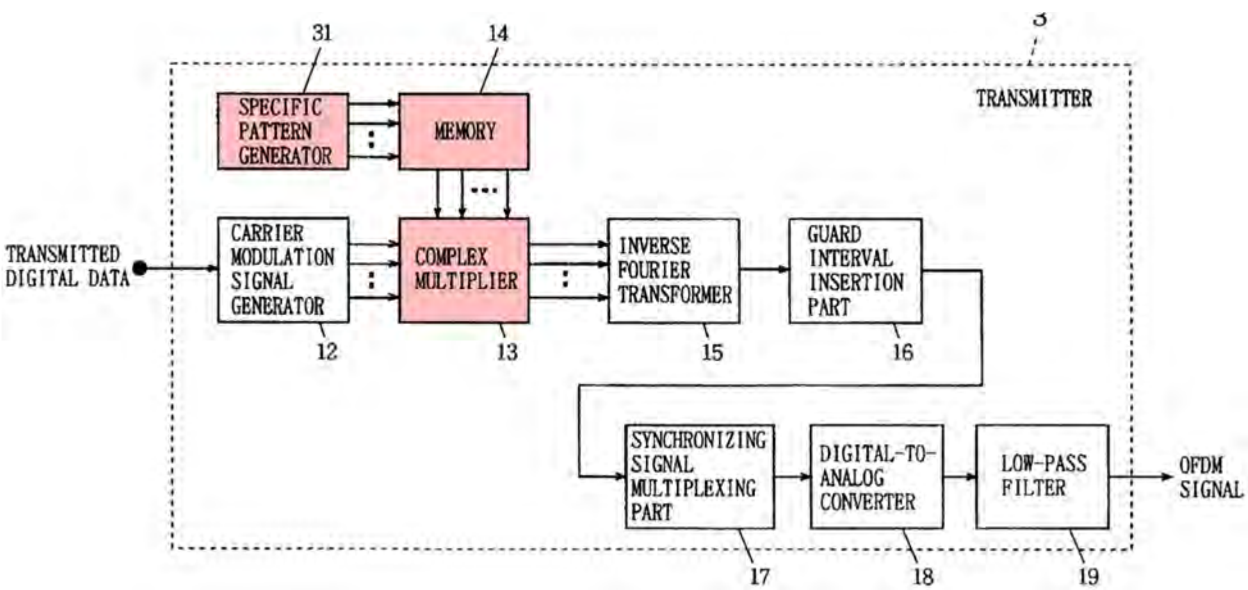
operates in the spectrum based on agreements/etiquettes imposed by the primary users or regulatory entities.").

[8] A POSITA would have understood that the depicted subcarriers are available for use by the plurality of transmitter devices, not just a subset. DISH-1004, ¶105.

[1b] "b) providing a corresponding element of a pseudorandom noise sequence for each subcarrier of the set of available subcarriers"

Hayashino's discloses [1b] through its use of pseudo-random sequences to vary carrier signal phase. DISH-1004, ¶¶107-118; DISH-1007, 12:27-48, FIG. 9.

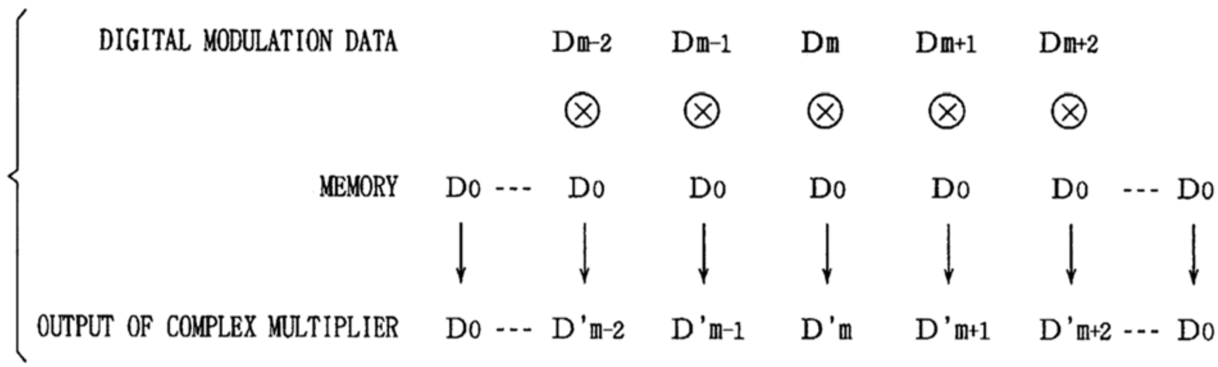
Hayashino's transmitter includes a "memory 14 [that] holds an output of a specific pattern generator 31, i.e., a complex signal group DO having a predetermined specific pattern with signals which mutually vary in phase at random" wherein "complex signal group DO can be formed by a pseudo-noise signal generator comprising a PN series pseudo-random signal generator." DISH-1007, 12:27-35; DISH-1004, ¶109.



HAYASHINO, FIG. 9

In Hayashino's transmitter, "complex multiplier 13 complex-multiplies data D_m of each symbol interval by data D_0 on the frequency axis every time data D_m is inputted for forming data D'_m ($D'_m = D_m \times D_0$), thereby randomizing mutual phases

of respective carrier modulation signals included in a carrier modulation signal group to specific patterns" as illustrated in below Figure 11. *Id.*, 12:43-46, 13:8-12, FIG. 11; DISH-1004, ¶110.



HAYASHINO, FIG. 11

Regarding [1b], a POSITA would have understood that input D_0 is a "corresponding element of a pseudorandom noise sequence" and that D_m represents an "available subcarrier." DISH-1004, ¶¶111-113 (explaining D_m represents an available subcarrier because a signal may be sent along the associated subcarrier); DISH-1007, 1:66-2:6, 13:13-18 ("The inverse Fourier transformer 15 allots the carrier modulation signal group D'm to respective carriers which are lined up on the frequency axis in every symbol, and collectively performs inverse Fourier transformation and parallel-to-serial conversion thereon,

thereby converting the same to a digital OFDM signal.”).[9] Because D_0 is provided for each D_m, Hayashino also provides the corresponding element of the PN sequence “for each subcarrier” used. *Id.*; DISH-1004, ¶113.

Notably, Hayashino teaches that its method of randomizing carrier phase reduces interference and “power concentration” in the OFDM signal output from inverse Fourier transformer 15. DISH-1007, 3:14-36, 13:18-25, 14:7-18, FIGS. 9, 15. A POSITA reading Hayashino would have understood this refers to reducing signal PAR, which is desirable for the reasons noted above. DISH-1004, ¶114; §IV.A.3. Indeed, references teaching the benefits of reducing PAR are commonplace, e.g.:

- Fazel notes that one of the disadvantages of OFDM-based multi-carrier modulation is a high … PAPR[10] requir[ing] high linear amplifiers.” DISH-1008, 34.

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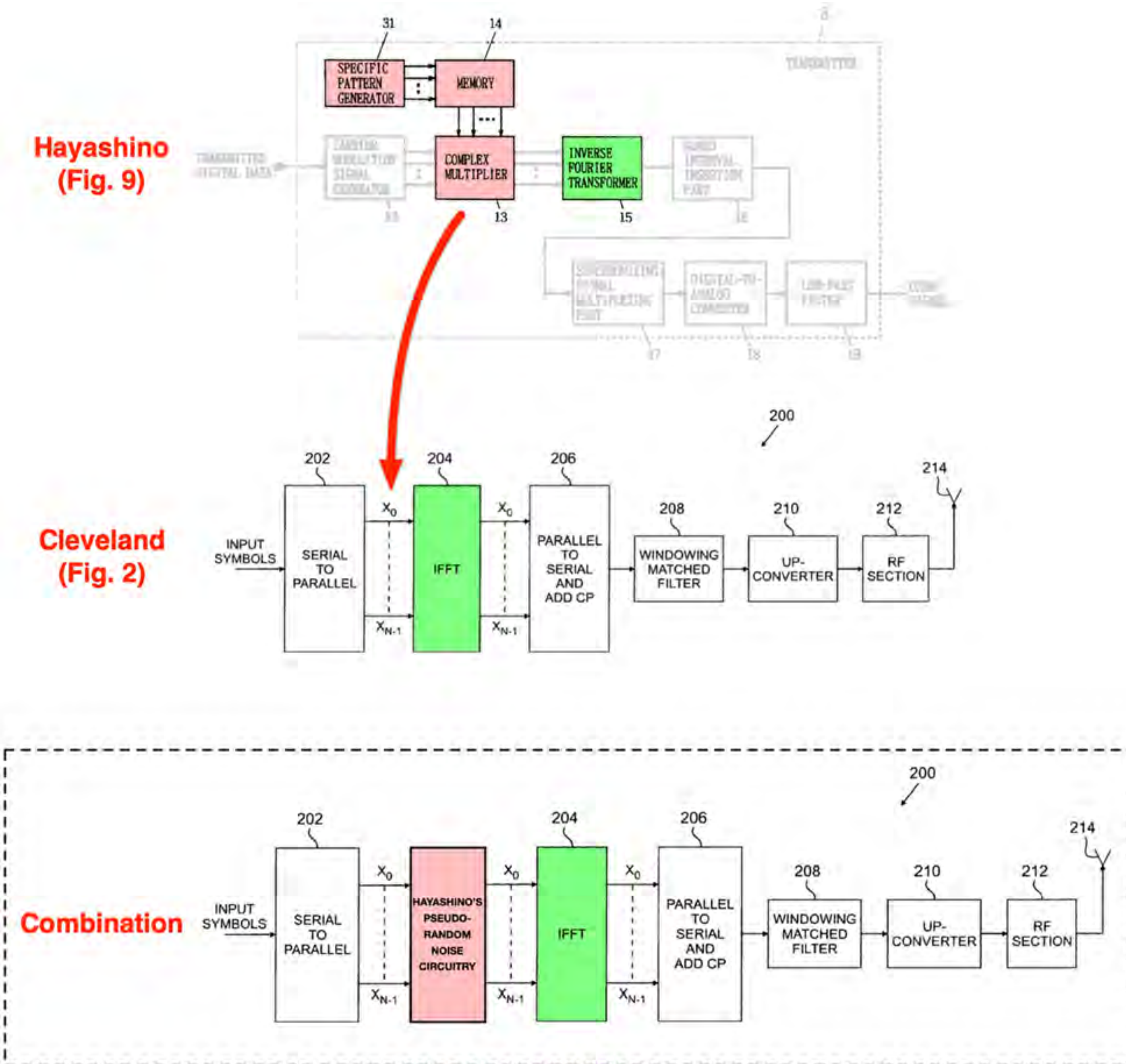
[9] Although Hayashino does not explicitly recite “available subcarrier,” a POSITA would have understood that Hayashino’s reference “to respective carriers” means a subcarrier, particularly within an OFDM context. DISH-1004, ¶112.

[10] “PAPR” is “peak to average power ratio,” which is synonymous with PAR. DISH-1004, ¶115, DISH-1009, 49.

- Tzannes observes that "[i]f the phase of the modulated carriers is not random, then the PAR can increase greatly." DISH-1009, 2:10-11.
- Nanba also teaches that when subcarrier phases in an OFDM signal are aligned the "waveform … PAPR (Peak to Average Power Ratio) is large, and the amplifier is burdened." DISH-1010, 5.
- Moffat explains that "[b]ecause the OFDM signal is the sum of a large number of subcarrier signals, it can have a high peak-to-average amplitude or power ratio." DISH-1011, ¶4.

DISH-1004, ¶115. None of these references were before the Examiner. *See* DISH-1001, Cover.

Accordingly, a POSITA would have been motivated to incorporate the pseudo-random noise circuitry of Hayashino's transmitter into Cleveland's transmitter for the reasons discussed in §IV.A.3, *supra*. The Cleveland-Hayashino transmitter is depicted below. DISH-1004, ¶116.



HAYASHINO, FIG. 9; CLEVELAND, FIG. 2; COMBINATION

In Cleveland-Hayashino, a POSITA would have had the devices multiply the data signals of parallel data stream x_0 through x_{n-1} using Hayashino's pseudo-random noise circuitry before undergoing the inverse fast Fourier transform (IFFT) of Cleveland's block 204. DISH-1004, ¶117. This would have achieved the results

of Hayashino's pseudo-random noise circuitry, described above, in Cleveland's transmitter.

Thus, Cleveland-Hayashino would have rendered obvious element [1b] because Hayashino's pseudorandom noise circuitry (31, 14, 13) discloses providing an element of a pseudorandom noise sequence to each subcarrier used in the OFDMA scheme. DISH-1004, ¶118.

[1c] "c) allocating a subset of the set of available subcarriers to each of the transmitting network devices"

Cleveland's pseudo-random subcarrier allocation discloses [1c].[11] DISH-1004, ¶119. As an initial matter, an OFDMA system allocates a subset of available subcarriers to transmitting devices, including base stations and remote devices (Cleveland's "subscriber stations"), in a given network. DISH-1004, ¶120. In its OFDMA system, Cleveland uses pseudo-random subcarrier allocation techniques to allocate subcarriers to secondary user nodes. DISH-1006, Abstract, ¶¶4-5, 41-

[11] This element describes how a basic OFDMA system operates—each transmitting network device receives dedicated frequency over which it transmits information. *See* DISH-1004, ¶120; DISH-1008, 118-120, 123-24.

44; DISH-1004, ¶121.[12] Cleveland's pseudo-random subcarrier allocation technique thus discloses "allocating a subset of the set of available subcarriers to each of the transmitting network devices." DISH-1004, ¶122.

In Cleveland-Hayashino, Cleveland's network would apply Hayashino's scrambling technique to each subcarrier that is available for use. Cleveland uses broadcast frames that contain information about which sub-channels are "usable sub-channels." DISH-1006, ¶52; DISH-1004, ¶123. Cleveland's secondary users have dynamic access to various sub-carriers. DISH-1006, ¶¶55-57 ("The available spectrum and/or sub-carriers for use by the secondary users are time varying and location-dependent because of the traffic load and distribution of the primary users."). Within this network, "SU [secondary unit] MAP 636 identifies those sub-carriers that are usable by secondary users." *Id.*; *see also* ¶¶69-70 (Cleveland's secondary nodes uses an OFDM/OFDMA broadcast frame ultimately to "ascertain which set[s] of sub-carriers" are available.). DISH-1004, ¶123.[13]

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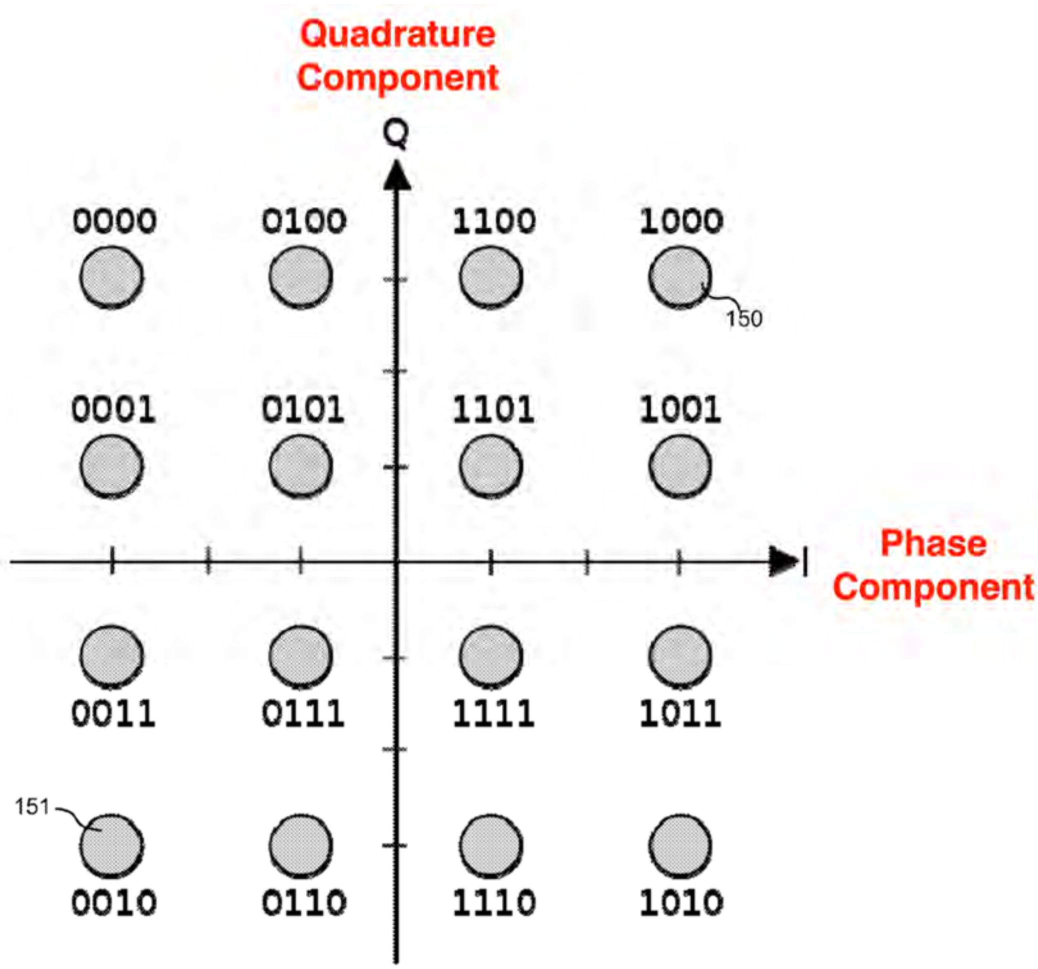
[12] A secondary user node "refers to a spectrum user who is not an owner of the spectrum but who operates in the spectrum based on agreements/etiquettes imposed by the primary users or regulatory entities." DISH-1006, ¶55.

[13] "MAP" refers to the uplink application map or downlink allocation map, depending on whether the message is transmitted or received. DISH-1004, ¶124.

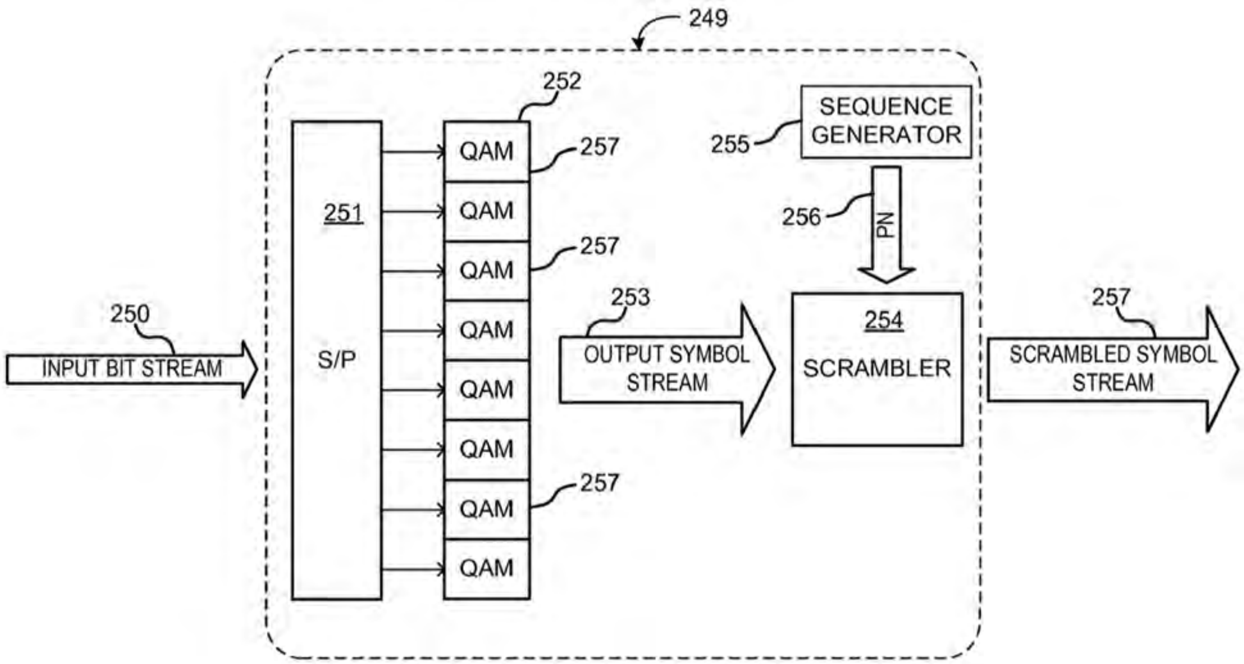
[1d] "d) [i] a transmitting network device of the plurality of devices [ii] mapping a packet onto a plurality of used subcarriers of its allocated subset of available subcarriers, wherein the step of mapping the packet comprises [iii] mapping the packet onto a plurality of quadrature amplitude modulated symbols to be transmitted on the used subcarriers"

As the '566 patent sets forth, "quadrature amplitude modulated symbols" refers to PHY data that is "modulated onto a plurality of frequency subcarriers … using quadrature amplitude modulation (QAM)" where "[t]he two subcarriers are termed the (Q) component and the in phase (I) component." DISH-1001, 4:8-21, FIG. 2 (reproduced below); DISH-1004, ¶126.



’566 PATENT, FIG. 2

Referring to Figure 4 (reproduced below), the ’566 patent discloses that “[i]nput bit stream 250 may represent a PHY packet” and “coding module 249 transforms the serial bit stream to a parallel stream using serial-to-parallel module 251” which “is then presented to a QAM module 252.” DISH-1001, 5:59-66, FIG. 4; DISH-1004, ¶127. Thus, the ’566 patent maps PHY packets using QAM.



’566 PATENT, FIG. 4

For subpart [1d.i], Cleveland discloses, with its OFDM/OFDMA transmitter (200), a transmitter in each “transmitting network device.” DISH-1006, ¶36;

DISH-1004, ¶128.[14] A POSITA would have understood or found obvious having this transmitter present in each base station and remote device in Cleveland's network. *Id.*

For subpart [1d.ii], one of Cleveland's transmitters "map[s] a packet onto a plurality of used subcarriers of its allocated subset of available subcarriers." DISH-1004, ¶129. Cleveland maps packets onto subcarriers, which in the Cleveland-Hayashino combination are represented by D_m, with a mapping function in a serial-to-parallel converter. *See id.*; DISH-1006, ¶¶36, 62.

For subpart [1d.iii], Cleveland maps PHY packets using QAM symbols. *See* DISH-1004, ¶130; DISH-1006, ¶¶36, 62. Specifically, Cleveland discloses an "OFDMA physical layer (PHY)" that "supports sub-channelization in both the up-link (UL) and the down-link (DL)" utilizing "diversity permutation [that] draws sub-carriers pseudo-randomly to form a sub-channel." DISH-1006, ¶45. Cleveland teaches that "a typical OFDM/OFDMA transmitter … constructs … an OFDM/OFDMA composite signal by first passing the serial output of a formatted, encoded, interleaved data signal through serial-to-parallel converter 202[, that] separates each data signal into parallel data streams." *Id.*, ¶¶36, 62, FIG. 2. Then,

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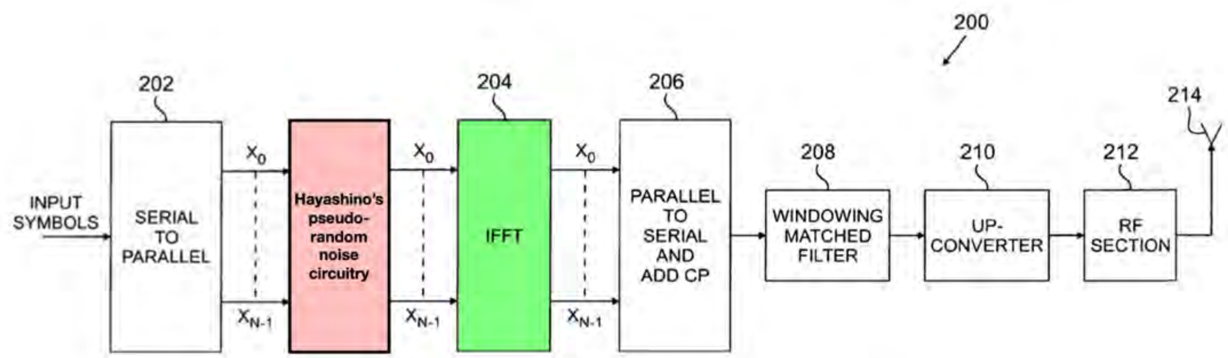
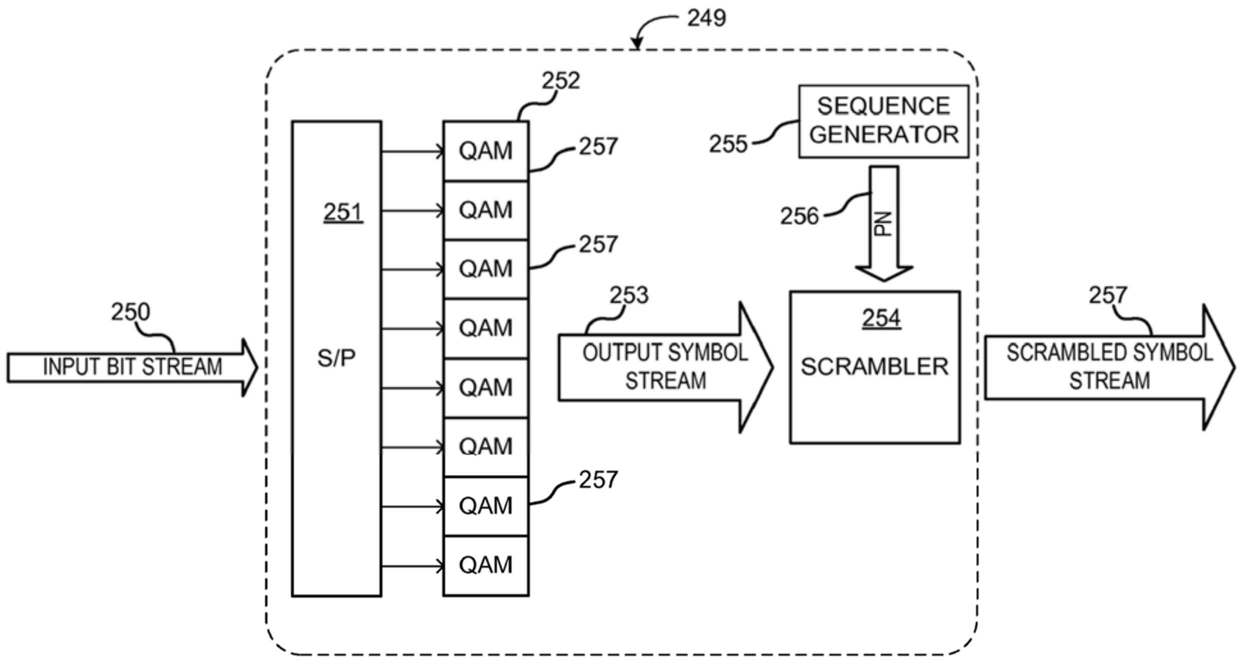
[14] Although a single transmitter is discussed, it is understood the discussion applies to multiple transmitters. DISH-1004, ¶128.

a "***mapping function (MAP) within serial-to-parallel converter 202 maps each parallel data stream into I and Q modulation symbols***, which are then applied to inverse fast Fourier transform (IFFT) block 204." *Id.*; DISH-1004, ¶130.



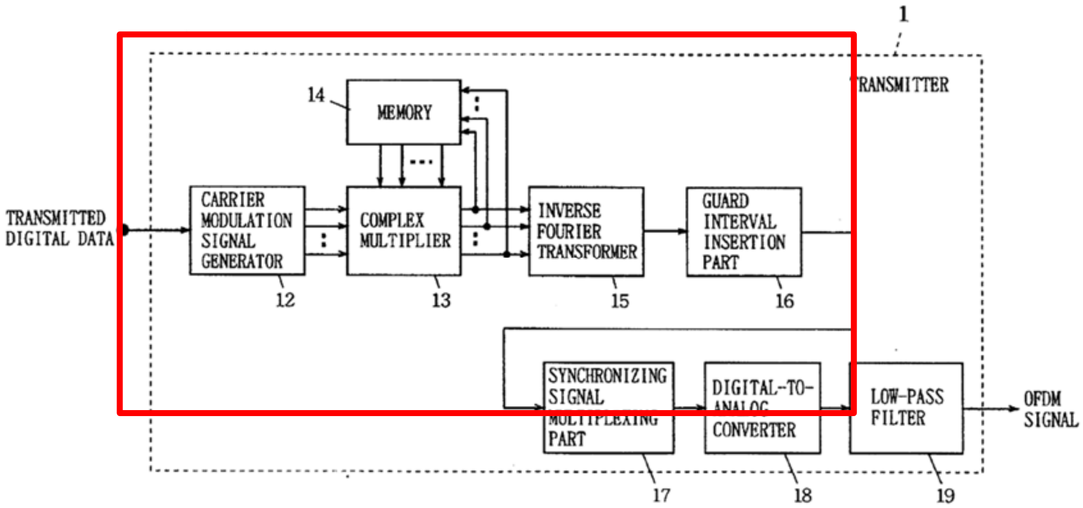
CLEVELAND-HAYASHINO COMBINATION

A POSITA would have understood that Cleveland's serial data signal or "Input Symbols" shown in Figure 2 corresponds to "input bit stream 250" from Figure 4 of the '566 patent (reproduced below). DISH-1001, 5:59-6:10, FIG. 4; DISH-1006, FIG. 2; DISH-1004, ¶131.



’566 PATENT, FIG. 4

As detailed above, a POSITA would have had an expectation of success in combining Cleveland and Hayashino to utilize Cleveland’s transmitting and mapping functions because Hayashino discloses the same functions, which separately read on element [1d]. For example, as it relates to subpart [1d.i], Hayashino discloses a transmitter, as shown below in Figure 1. DISH-1007, 7:45-50, FIG. 1; DISH-1004, ¶132. This transmitter would be present in each base station and remote device in Cleveland’s network. DISH-1004, ¶133.



HAYASHINO, FIG. 1

For subpart [1d.ii], and with continued focus on the reasonable-expectation-of-success inquiry, Hayashino discloses mapping a packet onto available subcarriers by converting a serial signal into multiple parallel signals. DISH-1007, 7:51-60; DISH-1004, ¶134. For example, Figures 1 and 9[15] disclose a "carrier modulation signal generator 12" which "digital-modulates the inputted transmitted digital data and serial-to-parallel converts the same in every symbol interval, thereby converting the data to a carrier modulation signal group." DISH-1007, 7:51-57, FIGS. 1, 9.

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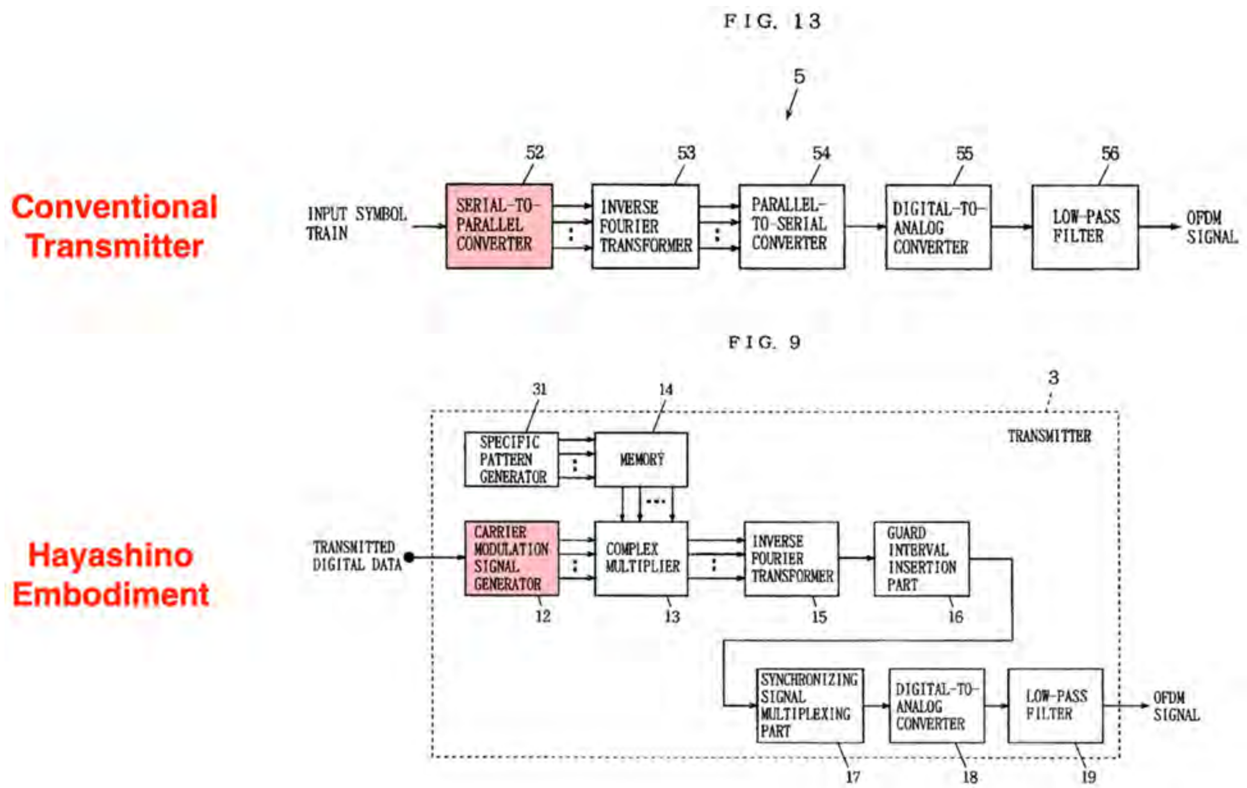
[15] Figure 9 is identical to Figure 1 with the addition of Specific Pattern Generator 31, and the description of the common elements of Figure 1 apply to Figure 9. DISH-1007, 12:24-27.

For subpart [1d.iii] and with continued focus on the reasonable-expectation-of-success inquiry, Hayashino discloses using QAM. DISH-1007, 7:51-60; DISH-1004, ¶135. For instance, Hayashino's "digital modulation is performed by … 16 QAM [and] in this stage is similar to that outputted from the serial-to-parallel converter 52 (see FIG. 13) of the conventional transmitter." *Id.*, 7:57-64, FIGS. 1, 9, 13.



HAYASHINO, FIGS. 13, 9

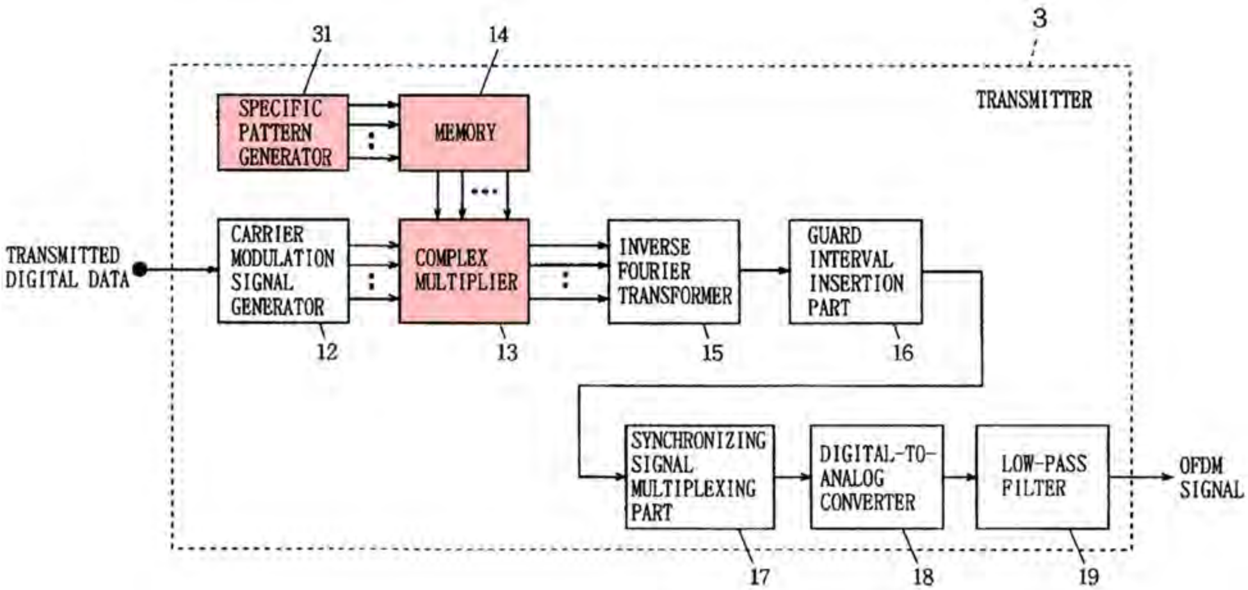
Thus, Cleveland and Hayashino render obvious element [1d]. DISH-1004, ¶¶125, 135. Further, the similarities between Cleveland and Hayashino underscore that a POSITA would have had a reasonable expectation of success in combining the references. *Id.*, ¶136.

[1e] "e) the transmitting network device [i] performing a predetermined transformation on a quadrature amplitude modulated symbol [ii] using the element of the pseudorandom noise sequence corresponding to the used subcarrier"

Hayashino discloses [1e] through using pseudo-random sequences to vary carrier signal phase (with Cleveland disclosing the remainder of the element). DISH-1004, ¶¶137-142; DISH-1007, 12:27-48, FIG. 9.

A POSITA would have understood Hayashino's transmitter is the "transmitting network device" that performs the predetermined transformation. DISH-1004, ¶139.

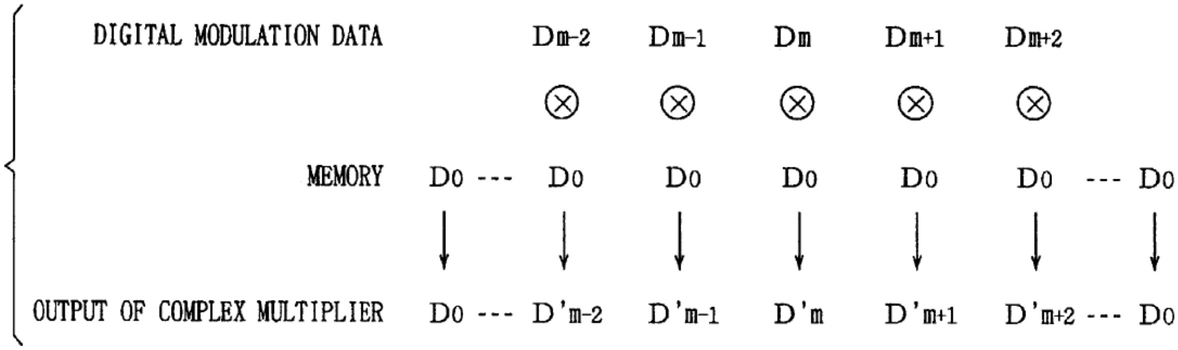
For subpart [1e.i], the output of Hayashino's complex multiplier discloses "performing a predetermined transformation on a [QAM] symbol." DISH-1004, ¶140. For example, Hayashino's transmitter features "memory 14 [that] holds an output of a specific pattern generator 31, i.e., a complex signal group D_0 having a ***predetermined specific pattern*** with signals which mutually vary in phase at random" wherein "complex signal group D_0 can be formed by a pseudo-noise signal generator comprising a PN series pseudo-random signal generator." *Id.*, 12:27-35, 12:43-48; DISH-1004, ¶141 (explaining Hayashino's specific pattern generator 31 is a pseudorandom noise sequence generator).



HAYASHINO, FIG. 9

Further, Hayashino discloses that the carrier modulation signal generator 12 performs "16 QAM." DISH-1007, 7:51-64, FIGS. 1, 9, 13. Thus, a POSITA would have understood that specific pattern generator 31's "predetermined specific pattern" is "performing a predetermined transformation on a quadrature amplitude modulated symbol" output by Hayashino's carrier modulation signal generator 12. DISH-1004, ¶141.

For subpart [1e.ii], a POSITA would have understood that Hayashino discloses "using the element of the pseudorandom noise sequence corresponding to the used subcarrier" when it performs the multiplication depicted in Figure 11 (below) and the IFFT 15 allots a carrier modulation signal D'm to respective carriers. DISH-1007, 13:8-28; DISH-1004, ¶142. Thus, Cleveland-Hayashino renders obvious [1e.ii].



HAYASHINO, FIG. 11

[1f] "f) the transmitting network device transmitting the transformed symbol to a receiving network device."

Cleveland discloses [1f] through a transmitter and corresponding receiver in Figures 2 and 3 (below), respectively. DISH-1006, ¶38, FIGS. 2, 3; DISH-1004, ¶¶143-146. In Cleveland, transmitter 200 "constructs … an OFDM/OFDMA composite signal" that is ultimately "transmitted via antenna 14." DISH-1006, ¶¶36-37. "OFDM/OFDMA receiver 300 detects the transmitted symbols and essentially reverses the process implemented by transmitter 200 described above." *Id.*, ¶38, FIGS. 2, 3.

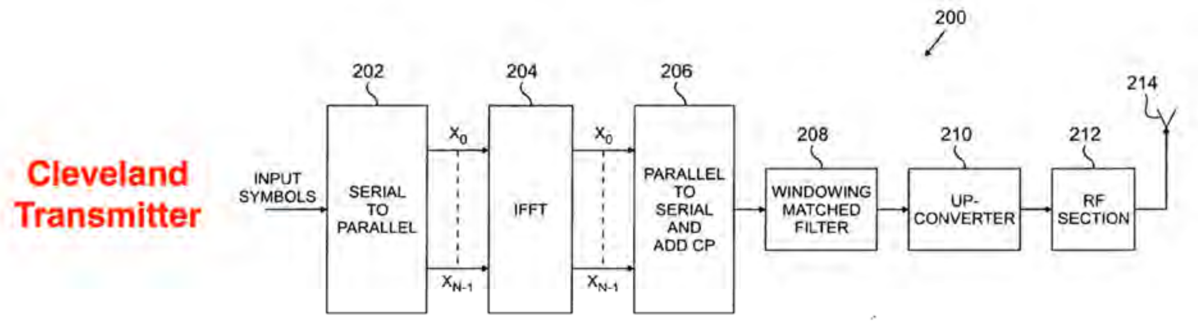


FIG. 2

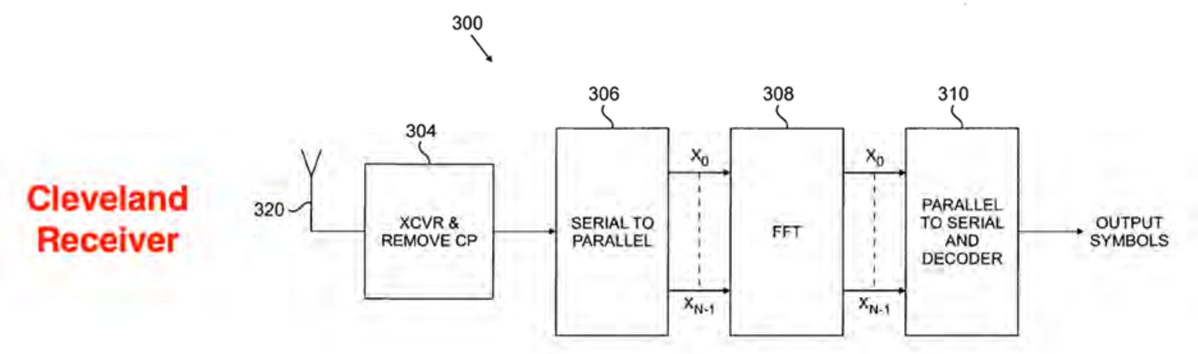


FIG. 3

CLEVELAND, FIGS. 2 AND 3

Similarly, Hayashino discloses a transmitter and corresponding receiver. DISH-1007, 7:26-44, FIGS. 1, 2; DISH-1004, ¶145. Hayashino's transmitter "outputs the OFDM signal including the guard intervals and the synchronizing signal to the transmission path" and its receiver receives the "OFDM signal … through the transmission path." DISH-1007, 7:45-9:32, FIGS. 1-2.

The combined Cleveland-Hayashino transmitter, and its corresponding receiver, would not alter either Cleveland's or Hayashino's principle of operation, as including Hayashino into Cleveland represents a simple addition rather than a

modification or substitution in either reference. DISH-1004, ¶146. Accordingly, in Cleveland-Hayashino, Cleveland's transmitter would transmit the transformed symbol to a receiver.

5. Claim 2

[2pre] "The method of claim 1, wherein the steps of providing a corresponding element of a pseudorandom noise sequence and performing a predetermined transformation comprise:"

To the extent limiting, Cleveland-Hayashino renders [2pre] obvious for the reasons discussed in Ground 1, elements [1b], [1e], [2a], and [2b], incorporated herein. DISH-1004, ¶147.

[2a] "a) the transmitting network device [i] receiving an initial pseudorandom noise sequence element from a pseudorandom noise sequence generator, [ii] the initial pseudorandom noise sequence element corresponding to a first available subcarrier and [iii] transforming the symbol to be transmitted on the first available subcarrier if the first available subcarrier is a used subcarrier; and" [16]

For subpart [2a.i], Hayashino's "specific pattern generator 31" discloses a pseudorandom noise sequence generator. DISH-1004, ¶¶148-154. Hayashino's

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[16] The '566 patent explains that "used subcarriers represent the sum of the subcarriers used by the individual transmitting network devices during the OFDMA communications period." DISH-1001, 7:63-65. Thus, "used subcarrier" has no specialized definition. DISH-1004, ¶149.

transmitter receives a PN sequence element from the pattern generator 31 when it sends an OFDMA transmission. *Id.*, DISH-1007, 12:27-42.

For subpart [2a.ii], Hayashino discloses using a pseudorandom signal generator to provide unique values for carrier modulation signals:

> A complex multiplier 13 complex-multiplies data Dm of each symbol interval by data D0 on the frequency axis every time data Dm is inputted for forming data D'm (D'm=Dm×D0), thereby randomizing mutual phases of respective carrier modulation signals included in a carrier modulation signal group to specific patterns.

DISH-1007, 12:43-48. In randomizing "respective" carrier signals, a POSITA would have understood or found it obvious to use the elements from Hayashino's pseudorandom signal generator on each subcarrier. DISH-1004, ¶151.

For subpart [2a.iii], Hayashino discloses transforming a symbol to be transmitted onto the first available subcarrier when it performs serial-to-parallel conversion and QAM modification. *See* DISH-1007, 12:43-48 (discussing complex multiplication), DISH-1004, ¶152. Accordingly, when using one of Hayashino's PN sequence elements to modulate a particular symbol, a POSITA would have understood that the PN sequence element corresponds to the used subcarrier. DISH-1004, ¶153; DISH-1007, 13:35-40 (the transmitter and receiver use the same subcarrier(s)), FIGS. 1, 2, 9; §IV.A.4.[1e], *supra*. Due to the synchronization between transmitting and receiving devices, this correspondence

applies equally to all PN sequence element/subcarrier combinations, including the initial PN sequence element and first available subcarrier. DISH-1004, ¶154 (explaining the transmitter and receiver must use the same PN sequence element to split/compile a signal).

[2b] "b) the transmitting network device advancing the pseudorandom noise generator to receive a next element of the pseudorandom noise sequence corresponding to a next available subcarrier and transforming the symbol to be transmitted on the next available subcarrier if the next available subcarrier is a used subcarrier."

As discussed in Ground 1, elements [1e] and [2a], incorporated herein, Hayashino discloses PN sequence elements that correspond to used subcarriers. DISH-1004, ¶¶155-56; DISH-1007, 12:27-48, FIG. 9. For each subcarrier to have its own PN value, a POSITA would have understood that Cleveland-Hayashino's PN sequence generator advances to the next element in the sequence, which is provided to the complex multiplier 13 for use in serial-to-parallel conversion. DISH-1004, ¶¶156-57; DISH-1007, 12:27-48, FIG. 9. The PN generator must advance to the next element to avoid applying the same mathematical operator to adjacent subcarriers. *Id.*

6. Claim 3

[3] "The method of claim 2, wherein the step of the transmitting network device advancing the pseudorandom noise generator is repeated until a symbol to be transmitted on a last used subcarrier is transformed."

As discussed under element [1b] and claim 2, Hayashino discloses implementing the "specific pattern generator 31" by "a PN series pseudo-random signal generator." DISH-1007, 12:27-38, FIG. 9; DISH-1004, ¶¶159-160. Hayashino explains that "[t]he complex multiplier 13 repeats such an operation for a prescribed period." DISH-1007, 13:7-8. Hayashino also explains that the PN sequence is advanced or incremented until a symbol to be transmitted on a last used subcarrier is transformed. *Id.*, 12:43-48 ("A complex multiplier 13 complex-multiplies data Dm of ***each*** symbol interval by data DO on the frequency axis ***every time*** data Dm is inputted…."), FIG. 9. A POSITA would have understood that each subcarrier should receive its own pseudorandom element to realize the PAR reduction Hayashino touts. *See* §IV.A.3; DISH-1004, ¶161; DISH-1014, 79-80, DISH-1012, 17:17-20; DISH-1013, 7:21-23. Accordingly, a POSITA would have understood claim 2's advancing-PN-generator step results in Cleveland-Hayashino repeating the step until a symbol to be transmitted on a last used subcarrier is transformed. DISH-1004, ¶¶161-162.

B. GROUND 1B: Cleveland-Hayashino, in view of Mutagi, renders claim 4 obvious

1. Overview of Mutagi

Mutagi reflects a POSITA's understanding of pseudorandom (PN) sequences. DISH-1004, ¶¶163-164. For example, Mutagi summarizes "the

fundamentals and the applications of PN sequences, and the methods of generating them with hardware" for the "practicing engineer." DISH-1014, 79 (Abstract). Mutagi explains that "[p]seudo random binary sequences (PRBSs), also known as pseudo noise (PN), linear feedback shift register (LFSR) sequences or maximal length binary sequences (msequences), are widely used in digital communications." *Id.*, 79. Mutagi notes that "PN sequences are also used for scrambling the data, at the same rate, to obtain even spectral energy distribution within the signal band." *Id.*, 87. Mutagi discloses many PN sequences—Table 2 shows PN sequences of 2-25 bits. DISH-1014, 83-84; DISH-1004, ¶163.

Table 2: Some feedback taps for maximal sequence length

No. of stages, *N*	Code length, *L*	No. of codes, *C*	Some tap sets used for feedback
2*	3	1	[2, 1]
3*	7	2	[3, 2] [3, 1]
4	15	2	[4, 3] [4, 1]
5*	31	6	[5, 3] [5, 2]
6	63	6	[6, 5] [6, 1]
7*	127	18	[7, 6] [7, 3] [7, 1]
8	255	16	[8, 6, 5, 4] [8, 6, 5, 3]
9	511	48	[9, 5] [9, 6, 4, 3]
10	1 023	60	[10, 7] [10, 3]
11	2 047	176	[11, 9] [11, 8, 5, 2]
12	4 095	144	[12, 6, 4, 1]
13*	8 191	630	[13, 4, 3, 1]
14	16 383	756	[14, 5, 3, 1]
15	32 767	1 800	[15, 14] [15, 4]
16	65 535	2 048	[16, 15, 13, 4]
17*	131 071	7 710	[17, 14] [17, 3]
18	262 143	7 776	[18, 11[[18, 7]
19*	524 287	27 594	[19, 6, 2, 1]
20	1 048 575	24 000	[20, 17] [20, 3]
21	2 097 151	84 672	[21, 19] [21, 2]
22	4 194 303	120 032	[22, 21] [22, 1]
23	8 388 607	356 960	[23, 18] [23, 5]
24	16 777 215	276 480	[24, 23, 22, 17]
25	33 554 431	1 296 000	[25, 22] [25, 3]

Mutagi's Figure 7 below describes a PN-15 sequence. DISH-1014; *id.*, 83; DISH-1004, ¶163.[17]

[17] Scheim, discussed below, also uses PN sequences in OFDM/OFDMA systems. DISH-1004, ¶164; DISH-1017.

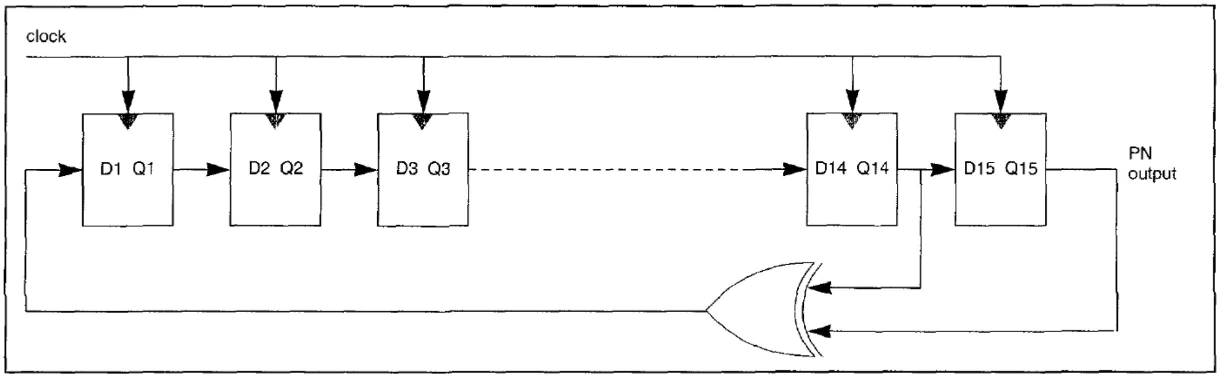

Fig. 7 A PN generator with polynomial $1 + x^{14} + x^{15}$

MUTAGI, FIG. 7

2. Cleveland-Hayashino in view of Mutagi

A POSITA familiar with the art would have known that using pseudorandom sequences is a well-known signal processing technique, as Mutagi shows. DISH-1004, ¶¶165-166.[18]

Mutagi discloses twenty-four PN sequences, ranging in length from 2-25. DISH-1014, 83-84; DISH-1004, ¶167. A POSITA would have also known that selecting the length is a design choice that involves assessing the complexity

[18] Mutagi explains that pseudorandom noise sequences "are widely used in digital communications." DISH-1014, 1. As Dr. Williams explains, "digital communications" encompasses multiplex communication in networks using orthogonal techniques (OFDM/OFDMA). DISH-1004, ¶166. Further, Mutagi is reasonably pertinent to the problems that the '566 patent's inventors faced, e.g., interference in OFDM/OFDMA systems. *Id.*

desired against the cost of the shift register. DISH-1014, 84 ("When the length *N* is large, more logic is needed with this technique to decode 'all zeros'."), 85 "(…the register length becomes prohibitive for large *L*."). Similarly, a POSITA would have understood that longer PN sequences generate more unique PN codes and that the number of users of a given network influences, or completely dictates, the length of the PN sequence required. *See* DISH-1014, 83 & Table 2. Accordingly, a POSITA would have found it obvious to try using any of the twenty-four PN sequences Mutagi discloses and to select a PN sequence that is appropriate for their particular application.

3. Claim 4

[4] "The method of claim 1, wherein the pseudorandom noise sequence comprises a PN-15 sequence."

Cleveland-Hayashino, coupled with a POSITA's knowledge as Mutagi reflects, render claim 4 obvious. DISH-1004, ¶168.

As noted above, Hayashino's specific pattern generator discloses a pseudorandom noise sequence. DISH-1004, ¶169; §IV.A.4.[1b]. Mutagi discloses 24 PN sequences, and it specifically discloses "a 15 bit PN sequence" throughout its discussion. DISH-1014, 80, FIG. 1. Because Mutagi discloses many PN sequences including a PN-15 sequence, and because a POSITA would have found

it obvious to try using any of those sequences, a POSITA would have found claim 4 obvious.

C. GROUND 1C: Cleveland-Hayashino, in view of Mutagi and Ting, render claim 5 obvious

1. Overview of Ting

Ting describes an approach to reducing the complexity associated with a preamble search in OFDMA networks. DISH-1015; DISH-1004, ¶170.

Ting explains that pilot symbols are used "for synchronization and channel estimation." DISH-1015, 23; DISH-1004, ¶171. Ting describes multiplying subcarriers by a "sequence to achieve randomization effect." *Id.* Specifically, Ting teaches that subcarriers can be randomized by multiplying each symbol against this factor:

$$2 \times (\frac{1}{2} - W_k)$$

DISH-1015, 24 ("The subcarrier randomization is accomplished as each modulated data subcarrier is multiplied by the factor [above.]").

2. Cleveland-Hayashino in view of Mutagi and Ting

A POSITA would have been motivated to increase the randomization in pilot signals in Cleveland-Hayashino-Mutagi's network to decrease the potential

interference in the network further. DISH-1004, ¶172.[19] Further, because pilot signals are critically important to system operation, a POSITA would be motivated to ensure that the pilot signal is not lost due to interference. *Id.* To avoid this problem, a POSITA would have been motivated to use an approach like Ting's, which helps ensure that network devices receive the appropriate pilot signals. Thus, applying Ting's teachings improves Cleveland-Hayashino regarding pilot signals. *Id.*

3. Claim 5

[5] "The method of claim 4, wherein the step of performing the predetermined transformation comprises rotating the quadrature amplitude modulated symbol by 180° if the element of the pseudorandom noise sequence is a '1' and not modifying the quadrature amplitude modulated symbol if the element of the pseudorandom noise sequence is a '0'."

Ting discloses multiplying pilot symbols by this factor:

$$2 \times (\frac{1}{2} - W_k)$$

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[19] Ting is analogous art—Ting is directed to an OFDMA system, and the references discussed in this petition pertain to OFDM/OFDMA. Ting also pertains to multiplex communication in networks using orthogonal techniques, and it is reasonably pertinent to the problems that the '566 patent's inventors faced, e.g., interference in OFDM/OFDMA systems. DISH-1004, ¶173.

DISH-1015, 23-24; DISH-1004, ¶¶174-175. As a POSITA would have understood, when a bit stream is multiplied by Ting's factor, the resultant product rotates a "1" to a "-1" and a "0" to a "1", which rotates the symbol (on a QAM constellation) by 180°. DISH-1004, ¶175.

D. GROUND 1D: Cleveland-Hayashino, in view of Mutagi and Ohana, Render Claims 6 and 12 Obvious

1. Overview of Ohana

Ohana explains that, in February 2006, the MoCA alliance had introduced a specification disclosing "technologies [that] provide throughput through the existing coaxial cables to the places where the video devices are located in a structure without affecting other service signals that may be present on the cable." DISH-1016, ¶¶7, 29; DISH-1004, ¶176.[20, 21] Ohana further explains that these

[20] MoCA 1.0 was introduced in 2006. DISH-1016, ¶29, DISH-1001, 1:66-67.

[21] Ohana is analogous art—Ohana's methods "may be used in connection with" MoCA 1.0, which is an OFDM network, as well as any coordinated network, which describes an OFDM/OFDMA network. DISH-1016, ¶¶29, 2-4; DISH-MONK (IEEE article overview of MoCA). Ohana thus also pertains to multiplex communication in networks using orthogonal techniques, and it is reasonably

networks are "coordinated networks, in which a processing unit serves as a network coordinator." DISH-1016, ¶¶11-12. Ohana also teaches that known coordinated networks, like MoCA networks, use reservation requests. *Id.* Ohana aims to improve known MoCA networks by reducing latency associated with delivering reservation requests. *Id.*, Abstract; DISH-1004, ¶177.

2. Cleveland-Hayashino in view of Mutagi and Ohana

A POSITA would have understood that Ohana discloses known components in a coordinated network—i.e., network coordinators and reservation requests. DISH-1004, ¶178.

In the 2000's, wireless customers were demanding increased data speeds. DISH-1004, ¶179; DISH-1008, 10 ("The demand for high data rate wireless multi-media applications has increased significantly in the past few years."). A POSITA looking to increase data speeds on Cleveland-Hayashino's network would have been motivated to use Ohana's persistent reservation requests because they reduce reservation-request latency. DISH-1016, ¶¶13, 15, 29; DISH-1004, ¶179. Further, a POSITA would have had a reasonable expectation of success in using Ohana's

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pertinent to the problems that the '566 patent's inventors faced, e.g., coordinating communication in OFDM/OFDMA systems. DISH-1004, ¶181.

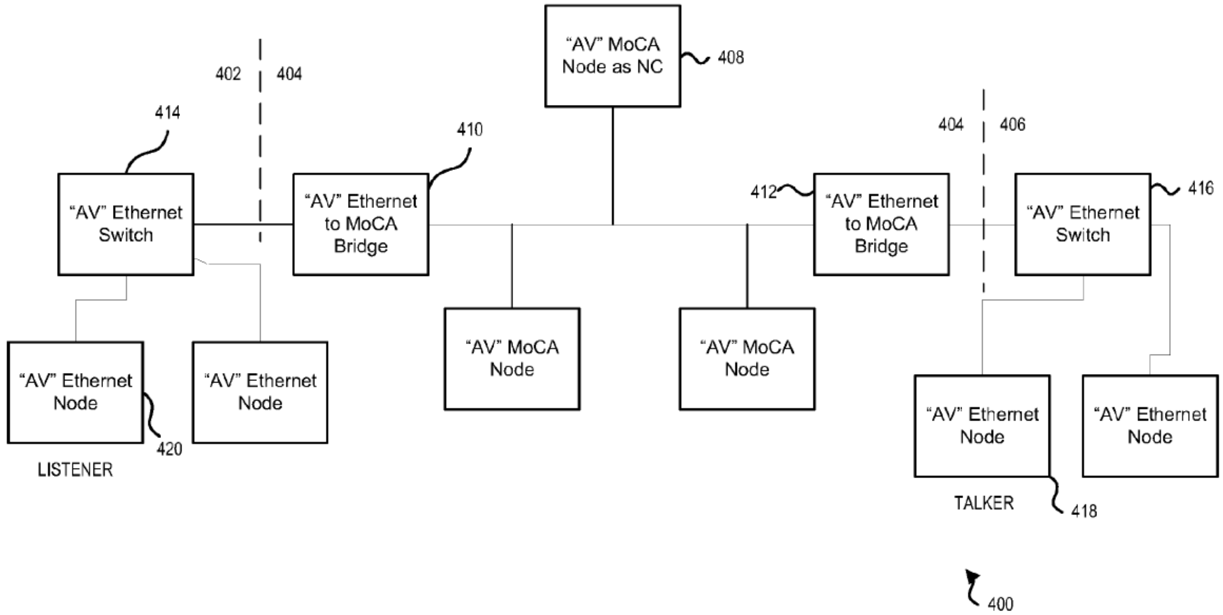
persistent reservation requests in Cleveland-Hayashino, because implementing the p-RR's would have been an exercise of ordinary skill. DISH-1004, ¶180.

3. Claim 6

[6] "The method of claim 4, wherein the receiving network device comprises a network coordinator and wherein the packet comprises a resource reservation request packet."

The '566 patent states that a network coordinator (NC) is a device in a multi-device network that "allocate[s] network bandwidth" among the devices. DISH-1001, 4:35-46. In coaxial home networks, this is performed by allowing "network devices to transmit a Reservation Request[s] (RR) ... for a certain amount of bandwidth at a certain time." *Id*. The '566 patent explains that "[t]he required time to receive these RRs grows with the size of the network." *Id*., 4:46-48. DISH-1004, ¶183.

Ohana Figure 4 (below) discloses a network 400 that includes a network coordinator 408. DISH-1016, ¶41, DISH-1004, ¶184.



OHANA, FIG. 4

Ohana's network uses persistent reservation requests ("p-RR") that "request allocation of network resources for transmitting the data. DISH-1016, ¶¶29-30. Ohana thus discloses claim 6's network coordinator and reservation requests. DISH-1004, ¶184. Thus, Ohana renders obvious modifying Cleveland-Hayashino's receiver to be a network coordinator wherein the packet comprises a resource reservation request packet. *Id.*, ¶¶182-84.

4. Claim 12

[12] "The method of claim 4, wherein the method is performed by a network coordinator and wherein first and second scrambled orthogonal frequency division modulation symbols are contained in a resource reservation request packet.

Cleveland-Hayashino renders claim 12 obvious based on the rationale presented under claims 1, 4, and 6, incorporated herein. DISH-1004, ¶185.

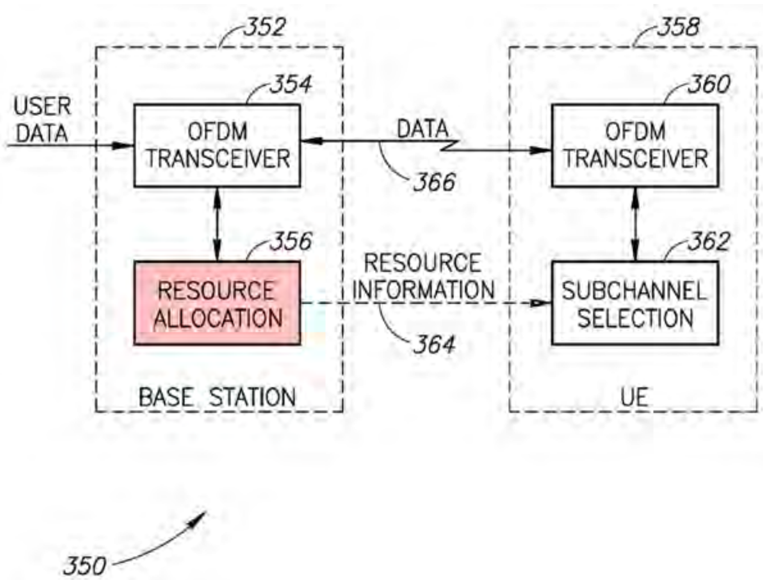
Furthermore, a POSITA would have found it obvious to include a scrambled OFDMA symbol in a resource reservation request packet because multiplexed networks, like OFDM/OFDMA and ADSL, typically deliver reservation requests over multiple subchannels, which requires using at least two scrambled OFDM symbols. DISH-1004, ¶186; DISH-1016, ¶8. Additionally, including the scrambled OFDMA symbol in a resource reservation request lowers PAR across the network. DISH-1004, ¶186. Thus, a POSITA would have been motivated to use Cleveland-Hayashino's approach in reservation requests, to realize Cleveland-Hayashino's benefits across the network's entire operation. *Id.*

E. GROUND 2A: Scheim and Tzannes Render Claims 1-3 Obvious

1. Overview of Scheim

Like the '566 patent, Scheim is directed to addressing interference in OFDMA communications networks that use multiple-input multiple-output (MIMO) techniques. DISH-1017, Abstract, ¶¶2, 5-7, 14, 21, 39-40; DISH-1004, ¶187. Scheim addresses interference by providing a "resource allocation mechanism" that "spreads the resource allocation in each cell in a random manner." DISH-1017, ¶41. Resource allocation is "a problem of how to optimally allocate resources (i.e. power and rate) across a set of parallel and independent dimensions in frequency, time (fading state) and space (multiple antennas) given channel conditions[.]" DISH-1017, ¶36; DISH-1004, ¶188.

As background, Scheim explains that MIMO systems "employ an array of antennas at both the transmitter and the receiver." DISH-1017, ¶¶6-10; DISH-1004, ¶¶189-190. Such systems often utilize "OFDM, a digital multi-carrier modulation scheme," and "OFDMA is a multi-user version of the OFDM digital modulation scheme." DISH-1017, ¶¶11-15. Scheim explains that prior OFDM networks achieved resource allocation by forwarding a "resource allocation scheme generated by block 356 … to the OFDM transmitter" where "[t]he transmitter [] selects different amounts of data for the users to form an OFDM symbol." *Id.*, ¶¶34-35, FIG. 5.



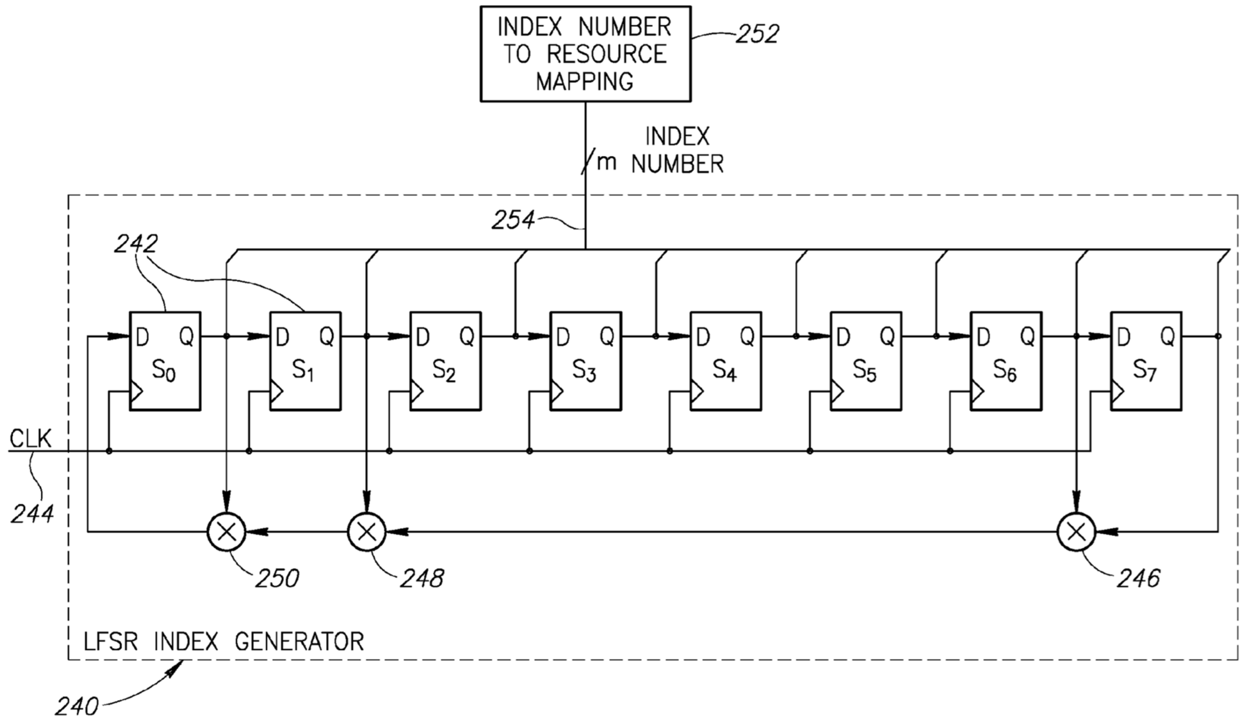
SCHEIM, FIG. 5 (PRIOR ART)

Scheim explains that resource allocation can be complex for two reasons—(1) a large number of users and (2) inter-cell interference. DISH-1017, ¶37; DISH-1004, ¶191. A large number of users in a cell presents a control-signal challenge,

because each user requires a unique control signal that "specif[ies] the corresponding resources allocated to it." *Id.* Inter-cell interference, which is caused by reusing the same resources over non-adjacent cells, presents a challenge because it required "complex and costly" "interference cancellation algorithms" to reduce the interference. *Id.*, ¶¶37-39.

To solve these challenges, Scheim discloses "a resource allocation scheme that functions to reduce inter-cell interference by randomizing the indices used to allocate resources in each cell." DISH-1017, ¶¶105, 41, 84; DISH-1004, ¶192. Scheim notes that "effectively spreading the resources in each cell over the entire resource range in a random manner [] results in statistical-like inter-cell interference behavior." *Id.* Thus, Scheim uses indices to distribute system resources, which includes OFDMA subchannels, randomly to various users on the network. DISH-1017, ¶¶106, 115.

To distribute system resources randomly, Scheim "employs a sequence generator for generating the random sequence of indices … [that] may comprise any suitable random number generating means." DISH-1017, ¶106; DISH-1004, ¶193. As shown below in Figure 9, Scheim discloses "a linear feedback shift register (LFSR) … to efficiently generate a sequence (i.e. permutation)" during transmission where "a LFSR with m bits ensures the pseudo-random generation of all the indices from 1 to 2^m-1. *Id.*, ¶¶111-112, FIG. 9.



SCHEIM, FIG. 9

Scheim discloses that when "a similar LFSR machine is employed at the receiver for calculating the corresponding permutation … the invention provides a relatively simple mechanism for the receiver to duplicate the sequence generated at the transmitter used to assign resources, when compared with other implementations." *Id.*, ¶113; DISH-1004, ¶194.

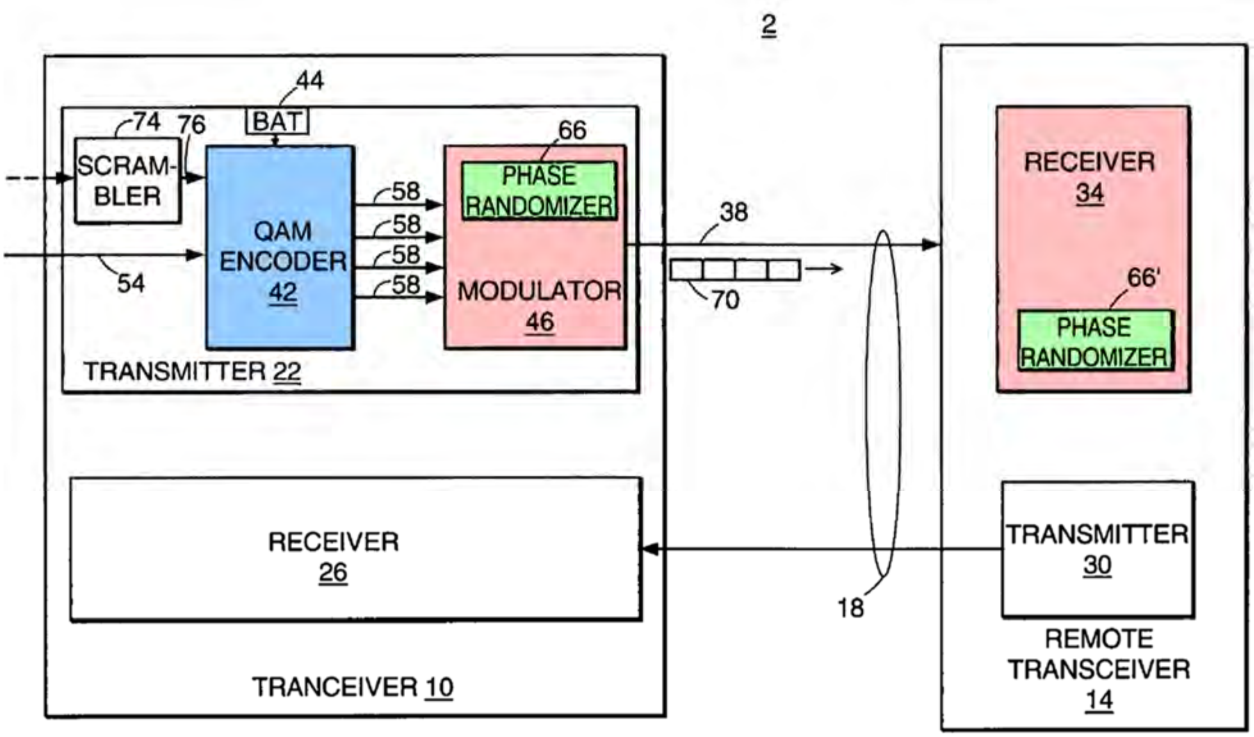
2. Overview of Tzannes

Like the '566 patent, Tzannes addresses interference in communications networks, particularly regarding carrier waves that constructively interfere with each other. DISH-1009, 2:10-26; DISH-1004, ¶¶195-199.

Tzannes discloses that, "[i]n a conventional multicarrier communications system, … [c]arrier signals (carriers) or sub-channels spaced within a usable frequency band of the communication channel are modulated at a symbol (i.e., block) transmission rate of the system." DISH-1009, 1:25-32; DISH-1004, ¶196. However, "[i]f the phase of the modulated carriers is not random, then the [peak-to-average power ratio (PAR)] can increase greatly." DISH-1009, 2:10-11. Tzannes explains that high PAR is undesirable because it "can result in a system with high power consumption and/or with high probability of clipping the transmission signal." *Id.*, 2:20-23. Tzannes thus identifies "a need for a system and method that can effectively scramble the phase of the modulated carrier signals in order to provide a low PAR for the transmission signal." *Id.*, 2:23-26; DISH-1004, ¶197.

Accordingly, Tzannes discloses various phase scrambling techniques that apply to multicarrier modulation methodologies "such as, but not limited to, orthogonally multiplexed quadrature amplitude modulation (OQAM) … and orthogonal frequency division multiplexing (OFDM)." DISH-1009, 3:33-36; DISH-1004, ¶198. Using a discrete multitone (DMT) transmitter as an example, Tzannes discloses a transmitter and receiver featuring "(QAM) encoder 42 [blue], a modulator 46 [red], … and a phase randomizer 66 [green]" where "QAM

symbols 58 represent the amplitude and the phase characteristic of each carrier signal." DISH-1009, 3:52-4:12, FIG. 1.



TZANNES, FIG. 1

"[P]hase scrambler 66 that combines a phase shift computed for each QAM-modulated carrier signal" resulting in "a substantially minimized [PAR]." *Id.*, 4:33-42. Finally, Tzannes teaches that "[t]he actual value(s) that the phase scrambler 66 associates with each carrier signal can be derived from … a pseudo-random number generator (pseudo-RNG)." *Id.*, 4:53-63; DISH-1004, ¶199.

3. Scheim-Tzannes Combination

The Scheim-Tzannes combination combines Scheim's OFDMA network, and associated devices, and pseudorandom distributing techniques with Tzannes's

pseudo-random phase shifting techniques.[22] DISH-1009, 2:1-26, 3:1-2, 6:30-40; DISH-1004, ¶200. This results in an OFDMA transmission scheme with improved bandwidth allocation and reduced PAR, which improves power consumption and lessens signal interference in Scheim's network. *Id.*

A POSITA would have been motivated to modify Scheim's network to incorporate Tzannes's approach. DISH-1004, ¶202. Both Scheim and Tzannes are directed to utilizing orthogonal frequency division data transmission techniques in communication networks. DISH-1017, ¶2 ("The present invention … relates to a resource allocation apparatus and method for use in an [OFDMA] communication system."); DISH-1009, 3:32-37 ("the principles of the invention apply … [to OFDM]."). Moreover, both are directed to overcoming inefficiencies in OFDM-based networks resulting from non-uniformly distributed carrier signals. DISH-1017, ¶¶37, 41 (Such signals "may cause interference to other cell transmissions"

[22] Scheim and Tzannes are analogous art to the '566 patent because they are from the same field of endeavor—multiplex communication in networks using orthogonal techniques—and because both references are reasonably pertinent to the problems that the '566 patent's inventors faced, e.g., interference in OFDM/OFDMA systems. DISH-1004, ¶201; DISH-1017, Abstract, ¶¶2, 5-7, 14, 21, 39-40; DISH-1009, 2:10-26.

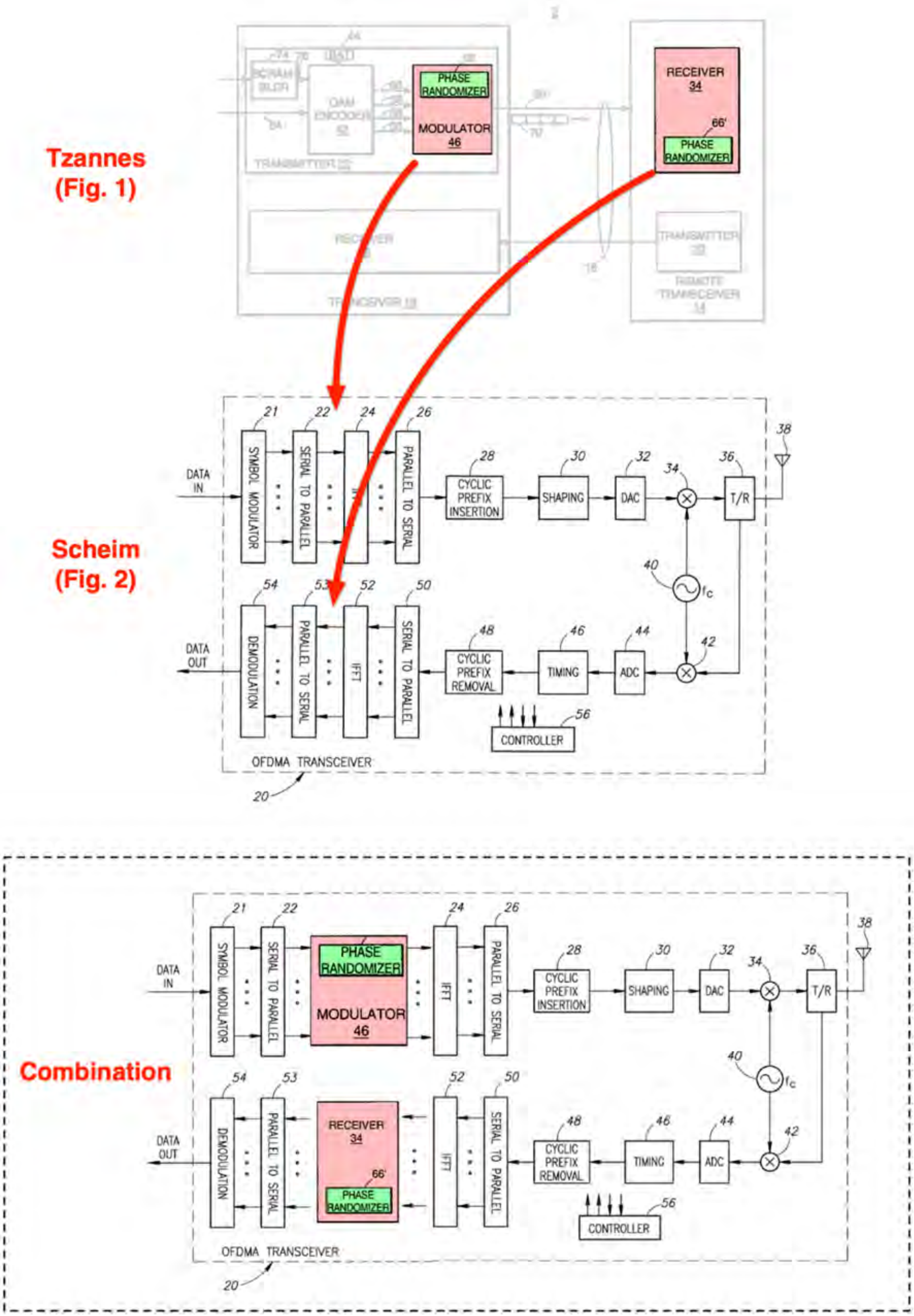
but "spreading the resources in each cell over the entire resource range in a random manner [] results in statistical-like inter-cell interference behavior."); DISH-1009, 4:39-42 ("By scrambling the phase characteristics of the carrier signals, the resulting transmission signal 38 has a substantially minimized [PAR]."). Thus, a POSITA seeking to improve Scheim's network, and interference on it, would have been motivated to look to similar communications technologies, like those in Tzannes, to reduce PAR. DISH-1004, ¶¶203-206.

Scheim further explains that conventional OFDM networks negotiate bandwidth by modulating and transmitting resource allocation data packets onto one or more subcarriers. DISH-1017, ¶¶34-35, FIG. 5; DISH-1004, ¶207. However, the non-random distribution of that data increases inter-cell interference. DISH-1017, ¶105. A POSITA would have understood that PAR increases as inter-cell interference increases. DISH-1004, ¶208. Likewise, Tzannes explains that when phase-shifted QAM-modulated carrier signals are transmitted using conventional OFDM techniques without random scrambling, it produces a high PAR. DISH-1009, 2:10-26. Thus, a POSITA looking to further improve the performance of Scheim's network would have looked to Tzannes's teachings to reduce PAR. DISH-1004, ¶208.

Moreover, both Scheim and Tzannes utilize QAM mapping to separate carrier signal phase (I or real) and quadrature (Q or imaginary) components for

transmission. DISH-1017, ¶11 ("[OFDM] … is well known in the art. It uses a large number of closely spaced subcarriers that are orthogonal to each other. Each subcarrier is modulated with a conventional modulation scheme [QAM]"); DISH-1009, 3:32-35 ("[T]he principles of the invention apply also to other types of multicarrier modulation, such as, … [QAM.]"); DISH-1004, ¶209. As such, incorporating Tzannes's approach in Scheim's network would not have required reworking Scheim's principle of operation or rendered either reference inoperable. DISH-1004, ¶209.

These efficiencies and similarities across Scheim and Tzannes's teachings would have led a POSITA to use Tzannes's pseudo-random phase-randomizing techniques in Scheim's network. DISH-1004, ¶210. Incorporating Tzannes's phase-randomizing technique, and accompanying circuitry, into Scheim's OFDMA transceiver would have been an exercise of ordinary skill (depicted below). *Id.*



TZANNES, FIG. 1; SCHEIM, FIG. 2; COMBINATION

A POSITA would have had a reasonable expectation that the Scheim-Tzannes combination would work successfully, as intended. DISH-1004, ¶211. Incorporating pseudorandom circuitry requires basic engineering knowledge and is an ordinary engineering task. *Id.* Indeed, Scheim ***explicitly*** discloses using a linear feedback shift register (LFSR) phase shifting circuit to perform randomized resource allocation mapping. DISH-1017, ¶¶107-113, FIGS. 7-8. A POSITA would have recognized that a LFSR is a type of pseudo-random permutation. *Id.*, ¶113; DISH-1004, ¶212. And a POSITA would have reasonably expected that this combination would experience the PAR reduction Tzannes teaches. DISH-1004, ¶213. Consistent with the teachings of Scheim and Tzannes, a POSITA would have also realized that PAR reduction is beneficial because it lessens signal interference, which in turn allow a POSITA to use less-powerful transmitters to reduce costs. DISH-1004, ¶214; DISH-1017, ¶¶10, 16, 36-40, 105-113; DISH-1009, 1:26-2:26. Further, a POSITA would have understood that lowering PAR allows the transmitter to operate at a higher power, thus extending range, or to conserve current, thus extending operating life in battery-powered devices. DISH-1004, ¶215.

4. Claim 1

[1pre] "A method for communications transmission using orthogonal frequency division multiple access on a network comprising:"

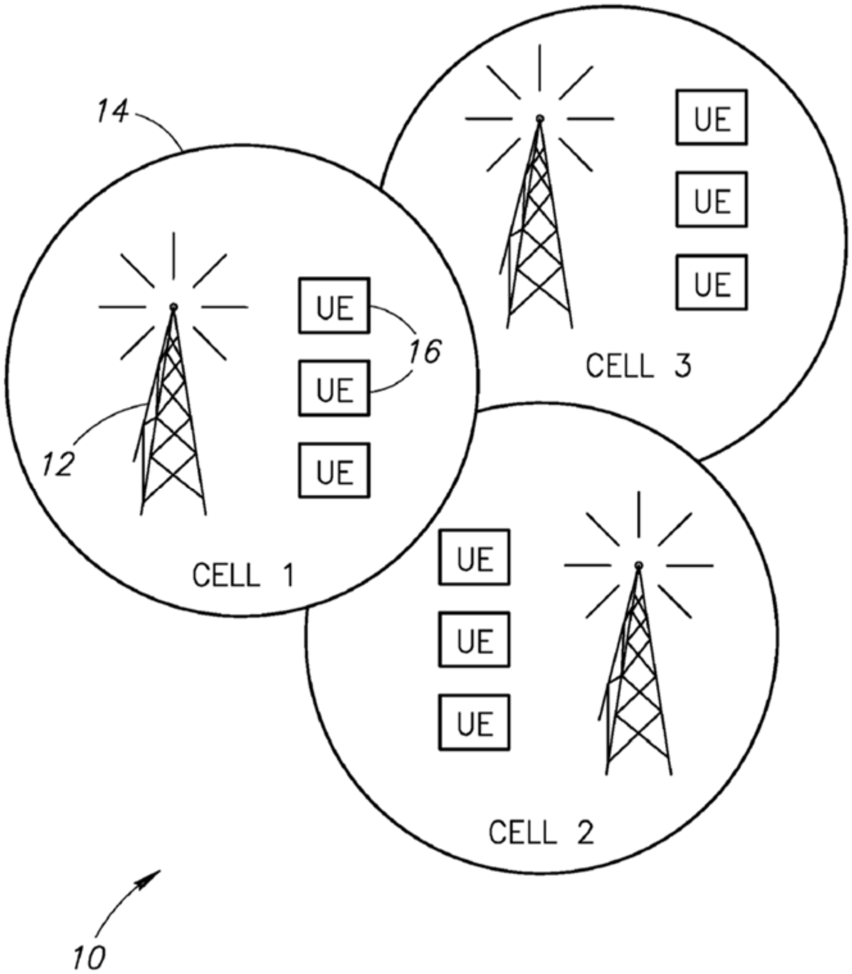
To the extent limiting, Scheim discloses [1pre] or renders it obvious in view of Tzannes. DISH-1004, ¶216.

Scheim comes from the OFDMA field, and discloses a conventional OFDMA transceiver, which works in an OFDMA network. DISH-1017, ¶¶2, 11-15; FIG. 2. Further, Scheim discloses methods for using OFDMA (particularly in connection with MIMO). DISH-1017, ¶¶21, 45, 130; DISH-1004, ¶¶217-219.

Tzannes similarly discloses that "the principles of the invention apply also to other types of multicarrier modulation, such as … [OFDM]." DISH-1009, 3:31-37, 3:47-51. A POSITA would have understood that Tzannes's concepts were applicable to Scheim's OFDM/OFDMA networks. DISH-1004, ¶¶220-221; DISH-1017, ¶¶15-16, FIG. 1 (showing system/network 10).

[1a] "a) providing a plurality of transmitting network devices with a set of available subcarriers for orthogonal frequency division multiple access"

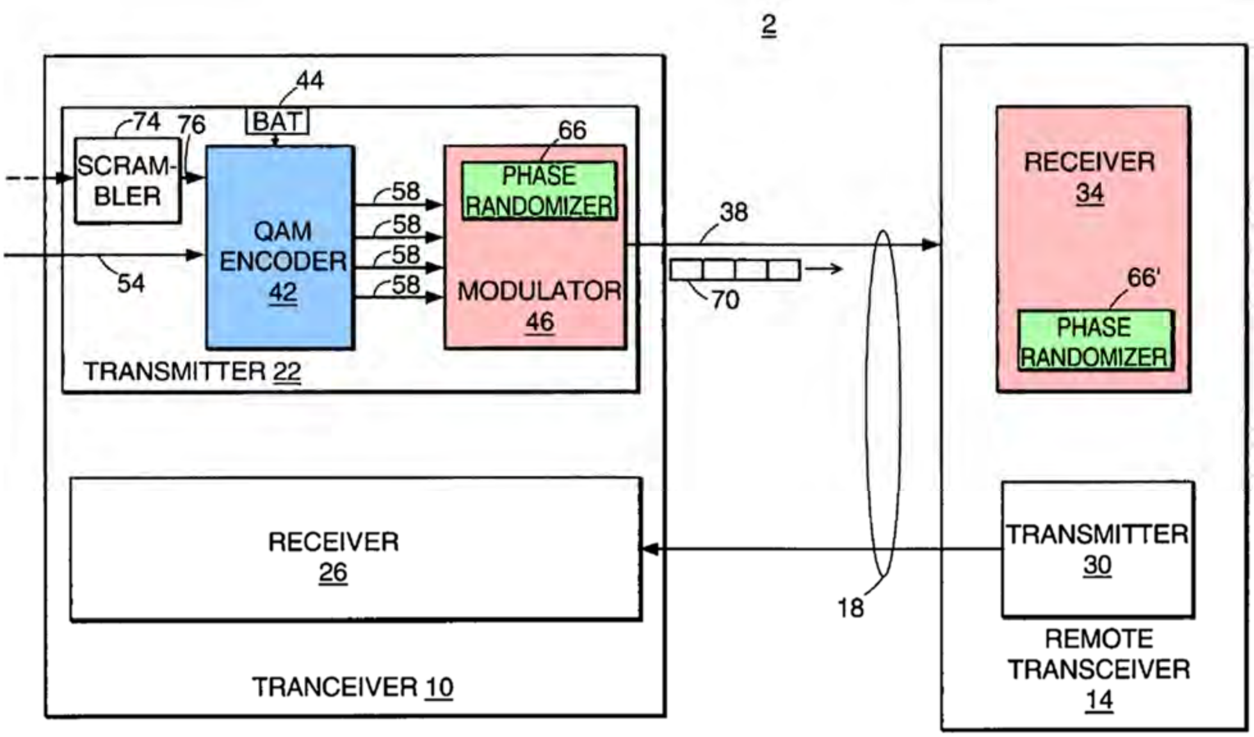
Scheim discloses that "[m]ultiple access is achieved in OFDMA by assigning subsets of subcarriers to individual users." DISH-1017, ¶15; DISH-1004, ¶¶222-223. Such a network is illustrated in Figure 1 (below), where "cells 14 (three in this example), each cell comprising a base station 12 [are] in wireless communication with a plurality of user equipment (UE) or mobile stations (MS) 16." *Id.*, ¶16, FIG. 1.



SCHEIM, FIG. 1 (PRIOR ART)

Similarly, Tzannes teaches a network "that scrambles the phase characteristics of the modulated carrier signals in a transmission signal" and that its principles "apply [] to other types of multicarrier modulation, such as … [OFDM]." DISH-1009, 2:20-33, 3:31-51. A POSITA would have understood that Tzannes's techniques apply to subcarriers, particularly because Tzannes references both carriers and sub-channels and because "phase scrambler 66 determines each

value for a carrier signal independently of the QAM symbols 58," as shown in Tzannes figure 1. DISH-1004, ¶224; DISH-1009, 4:52-63.



TZANNES, FIG. 1

[1b] "b) providing a corresponding element of a pseudorandom noise sequence for each subcarrier of the set of available subcarriers"

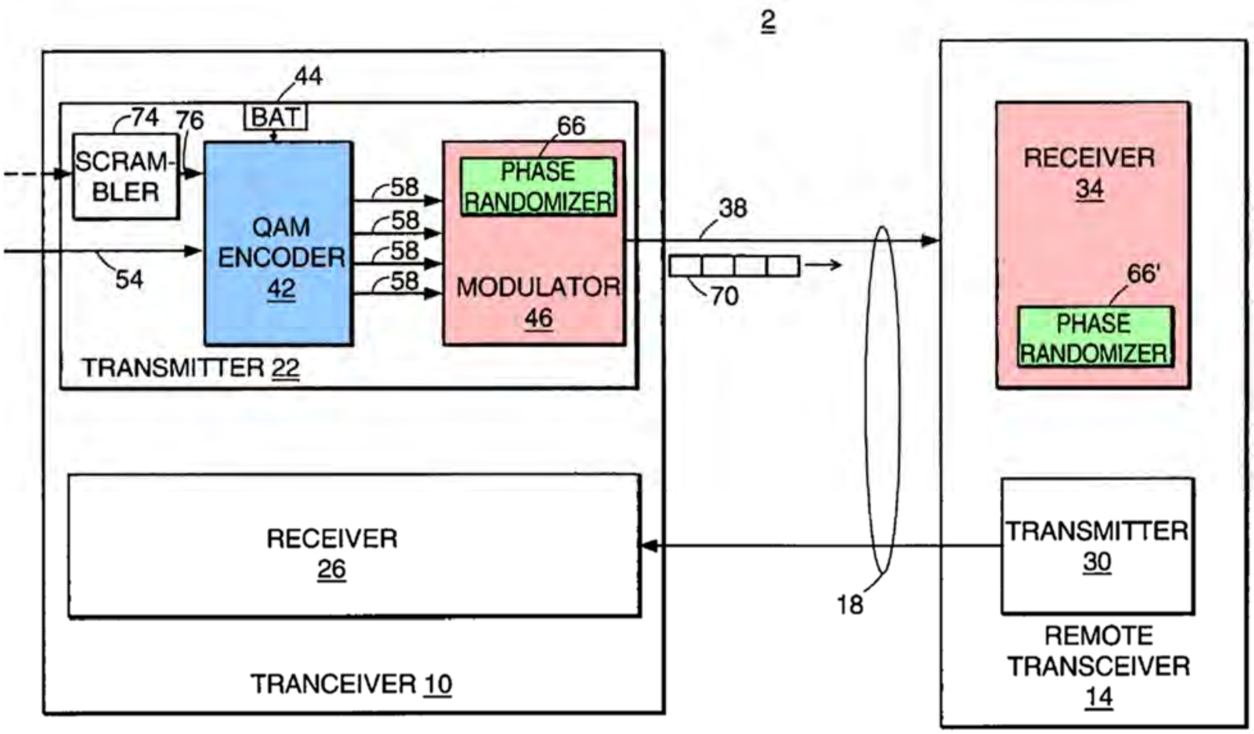
Tzannes discloses [1b] through use of pseudo-random sequences to vary carrier signal phase of OFDMA transmissions. DISH-1004, ¶¶225-233.

To begin, a POSITA would have understood that, because several synonymous terms are used to describe a "pseudorandom noise sequence," Tzannes's references to "phase scrambling" and "pseudo-RNG" are references to pseudorandom noise sequences. *See* DISH-1004, ¶227; DISH-1009, 4:52-67 (using "pseudo-RNG"); DISH-1014 (discussing "pseudo noise (PN)" sequences);

DISH-1001, 8:55-59 (identifying "generator polynomial X^{15}+X+l" as a "pseudorandom noise sequence"); DISH-1008, 71 (explaining that "[t]he property of a PN sequence is that the sequence appears to be noise-like if the construction is not known at the receiver.").

Tzannes discloses applying pseudorandom sequences to the phase component of each carrier signal "to produce a transmission signal with a reduced PAR," and thus provides elements of a pseudorandom noise sequence to each subcarrier. DISH-1009, Abstract, 2:43-3:2, 3:51-5:16, 6:29-31, FIG. 1; DISH-1004, ¶228. For example, Tzannes discloses providing "a [pseudorandom] value … associated with each carrier signal," and that "phase shift is computed for each carrier signal based on the value associated with that carrier signal." DISH-1009, 2:33-35, 47-57; DISH-1004, ¶229.

Regarding Figure 1, Tzannes explains that "modulator 46 [red] includes a phase scrambler 66 [green] that combines a phase shift computed for each QAM-modulated carrier signal with the phase characteristic of that carrier signal" and that "phase scrambler 66 can be part of or external to the modulator 46." *Id.*, 4:33-43, FIG. 1; DISH-1004, ¶230.

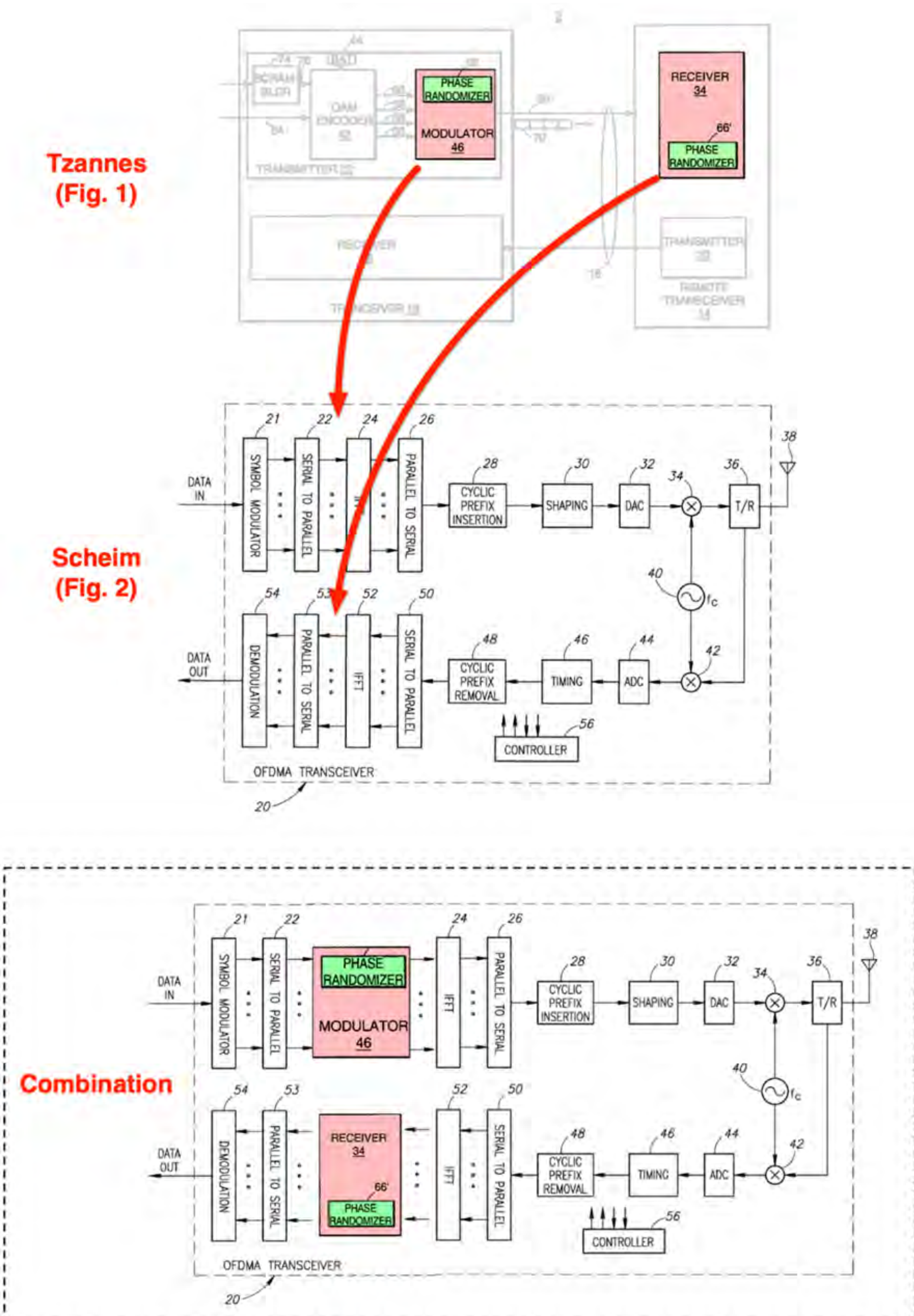


TZANNES, FIG. 1

Tzannes further discloses that "[t]he actual value(s) that the phase scrambler 66 associates with each carrier signal can be derived from one or more predefined parameters, such as a pseudo-random number generator (pseudo-RNG)." *Id.*, 4:52-67, FIG. 1; DISH-1004, ¶231. Tzannes then explains that it "adjust[s] the phase characteristic of each carrier signal" in a DMT system (e.g., an OFDM system). DISH-1009 5:17-36; DISH-1004, ¶232.[23]

[23] DMT is a wire-based implementation of OFDM. DISH-1004, ¶232.

As detailed above, incorporating Tzannes's phase scrambling techniques into Scheim's OFDMA transceiver would have yielded the following transmitter. §IV.E.3, *supra*; DISH-1004, ¶233.



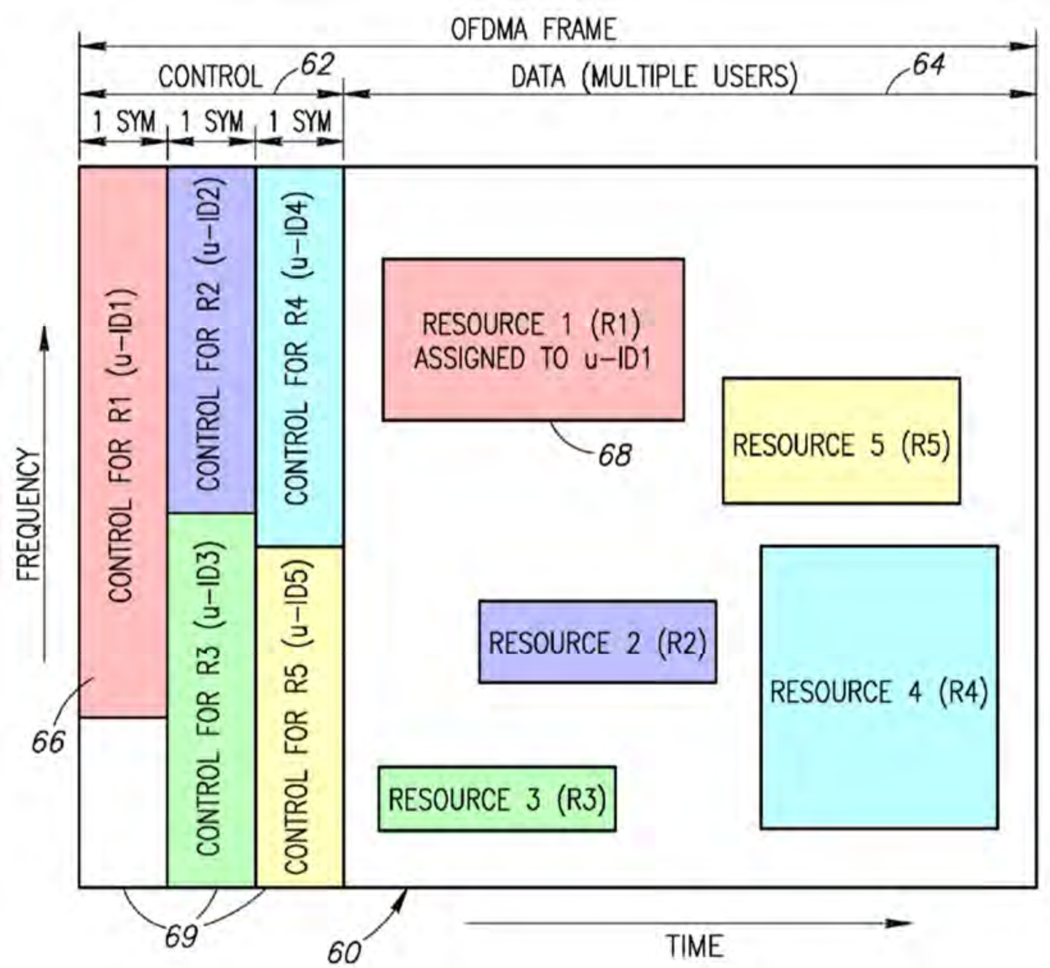
TZANNES, FIG. 1; SCHEIM, FIG. 2; COMBINATION

[1c] "c) allocating a subset of the set of available subcarriers to each of the transmitting network devices"

Scheim discloses element [1c]. DISH-1004, ¶¶234-237.

A POSITA would have understood that OFDMA networks allocate a subset of available subcarriers to transmitting devices. *Id.*, ¶235; DISH-1008, 118 (OFDMA "consists of assigning one or several sub-carrier frequencies to each user (terminal station) with the constraint that the sub-carrier spacing is equal to the OFDM frequency spacing $1/T_s$"). Thus, a POSITA would have understood Scheim's OFDMA network discloses element [1c]. DISH-1004, ¶235.

Scheim discloses this when it explains that "[m]ultiple access is achieved in OFDMA by assigning subsets of subcarriers to individual users." DISH-1017, ¶15; DISH-1004, ¶236. Specifically, Scheim discloses that a conventional OFDMA frame allocates user IDs ("u-IDs") and resource assignments ("R") across the frequency and time domain. *Id.*, ¶24. Figure 3 (below) illustrates such a conventional frame with five spectral resource allocations (R1 to R5) distributed among five users (u-ID1 to uID5). *Id.*, FIG. 3.

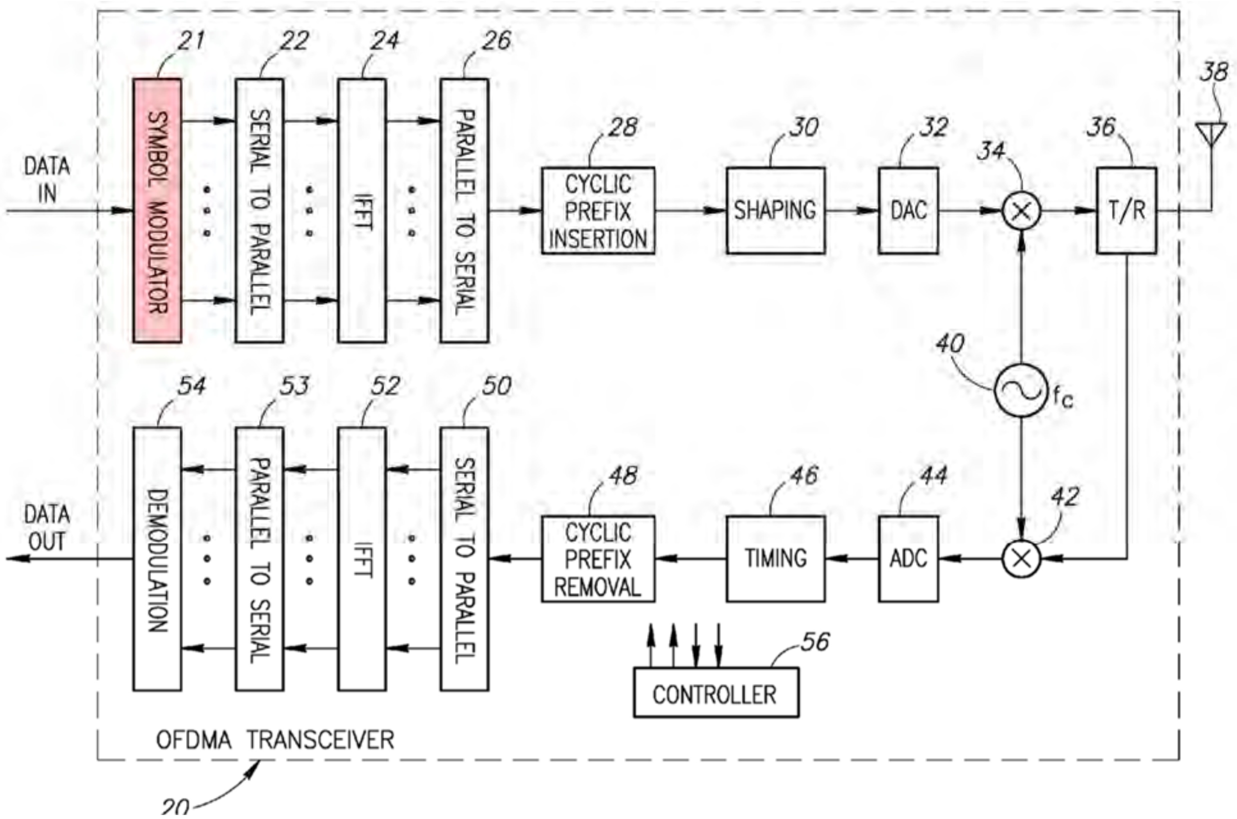


SCHEIM, FIG. 3 (PRIOR ART)

Scheim states that the control message helps users identify the system resources scheduled for the users (i.e., available resources for each of the users). DISH-1017, ¶¶25-26; DISH-1004, ¶237.

[1d] "d) [i] a transmitting network device of the plurality of devices [ii] mapping a packet onto a plurality of used subcarriers of its allocated subset of available subcarriers, wherein the step of mapping the packet comprises [iii] mapping the packet onto a plurality of quadrature amplitude modulated symbols to be transmitted on the used subcarriers"

For subpart [1d.i], Scheim discloses "a conventional OFDMA transceiver … [that] comprises a transmit path that includes a symbol modulator block 21." DISH-1017, ¶18, FIG. 2; DISH-1004, ¶239. Scheim teaches using quadrature amplitude modulation for the modulation scheme, e.g., the scheme used by the symbol modulator block 21 in Figure 2 below. DISH-1017, ¶11.



SCHEIM, FIG. 2 (PRIOR ART)

For subpart [1d.ii], Scheim discloses mapping a packet by converting a serial signal into multiple parallel signals, e.g., the symbol modulator generates modulated symbols that are mapped onto the assigned resources. DISH-1017, ¶18;

DISH-1004, ¶240 (the symbol modulator generates modulated symbols that are mapped onto the assigned resources).

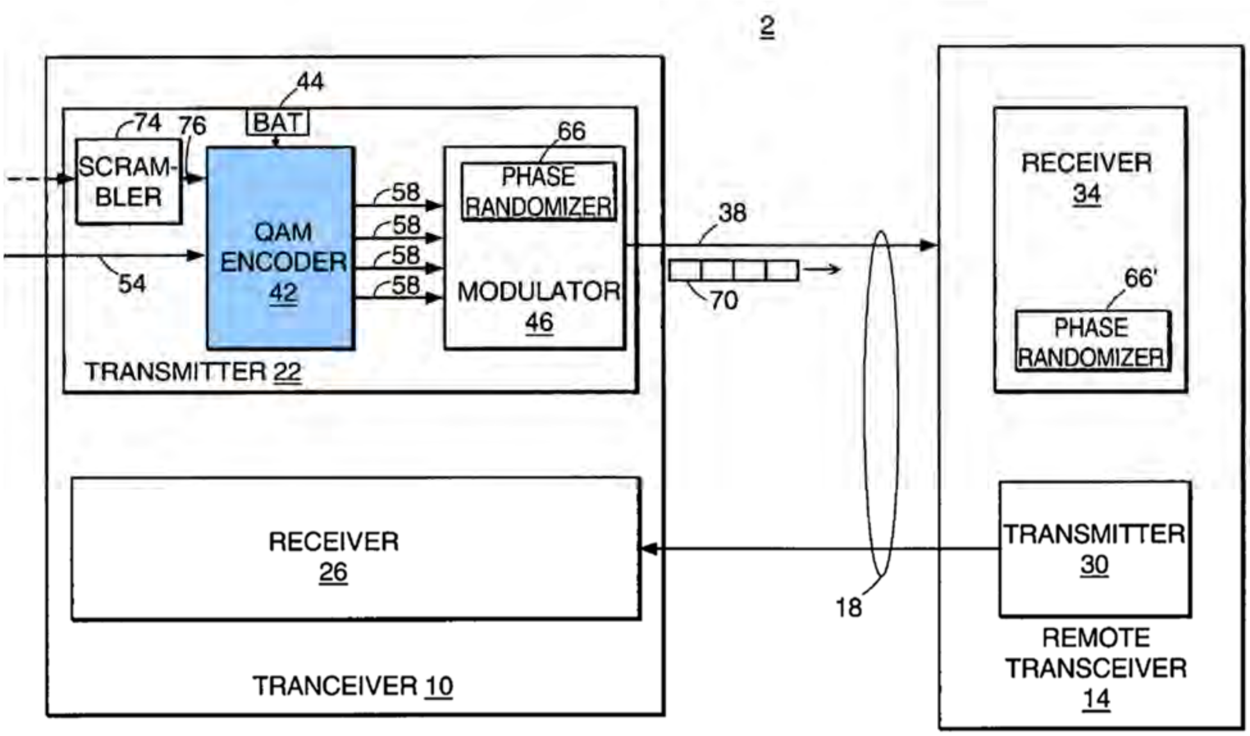
For subpart [1d.iii], Scheim discloses that its subcarriers are subsequently "modulated with a conventional modulation scheme (e.g., quadrature amplitude modulation (QAM))." DISH-1017, ¶11; DISH-1004, ¶241. A POSITA would have understood that the resultant QAM modulated symbols are transmitted on used subcarriers. DISH-1004, ¶242; DISH-1008, 140 (in multi-carrier modulation, "[a]fter symbol mapping (e.g. ***M-QAM***) and spreading (in MC-SS), each block of N_c complex-valued symbols is serial-to-parallel (S/P) converted and submitted to the multicarrier modulator, where ***the symbols are transmitted simultaneously on N_c parallel subcarriers, each occupying a small fraction (1/N_c) of the total available bandwidth B.***")

As detailed above, there would have been an expectation of success in combining Scheim and Tzannes as described to utilize Scheim's transmitting and mapping functions because Tzannes discloses the same functions recited in element 1d. DISH-1009, 3:64-4:11, 5:35-58; DISH-1004, ¶243.

For subpart [1d.i], Tzannes discloses a transmitter 22 that is a transmitting network device. DISH-1009, 3:52-54; DISH-1004, ¶244. Further, the transmitter includes a QAM encoder that "has a single input for receiving an input serial data

bit stream 54 and multiple parallel outputs to transmit QAM symbols 58 generated by the QAM encoder 42 from the bit stream 54." DISH-1009, 3:52-67, FIG. 1.

For subpart [1d.ii], Tzannes discloses that its transmitter maps packets onto subcarriers. DISH-1009, 4:2-7 ("QAM encoder 42 maps the input serial data bit stream 54 into N parallel quadrature amplitude modulation (QAM) constellation points 58, or QAM symbols 58, where N represents the number of carrier signals generated by the modulator 46."), FIG. 1 (below); DISH-1004, ¶245.

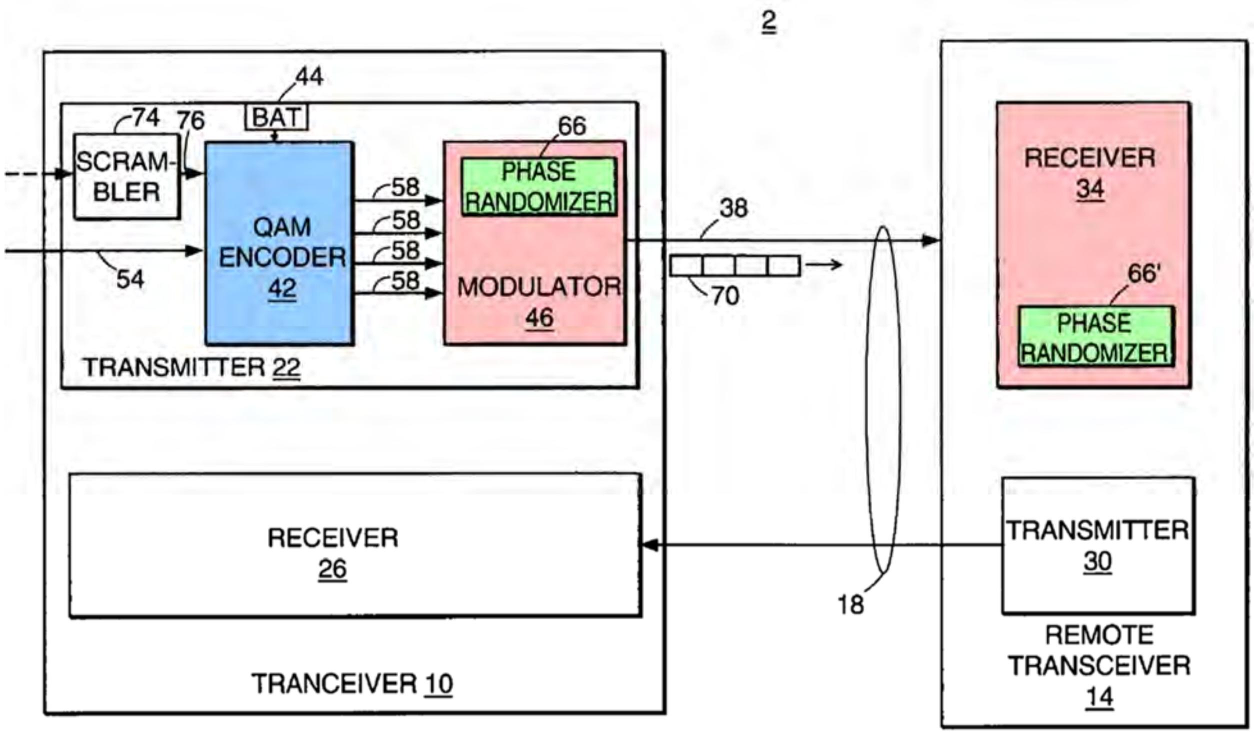


TZANNES, FIG. 1

For subpart [1d.iii] a POSITA would have understood that Tzannes discloses its QAM encoder uses QAM symbols to map the packet onto a used subcarrier. *Id.*, 3:64-4:11; DISH-1004, ¶¶246-247; DISH-1008, 140.

[1e] "e) the transmitting network device [i] performing a predetermined transformation on a quadrature amplitude modulated symbol [ii] using the element of the pseudorandom noise sequence corresponding to the used subcarrier"

Tzannes discloses [1e] through using pseudo-random sequences to scramble carrier signal phase (with Scheim disclosing the remainder of the element). DISH-1009, 4:52-54; DISH-1004, ¶¶248-254. Tzannes explains that, "[t]o compute a phase shift for each carrier signal, the phase scrambler 66 associates one or more values with that carrier signal." DISH-1009, 4:52-54, FIG. 1; DISH-1004, ¶250. "The phase scrambler 66 determines each value for a carrier signal independently of the QAM symbols 58, and, therefore, independently of the bit value(s) modulated onto the carrier signal." *Id.*, 4:54-57, FIG. 1. Tzannes further teaches that "[t]he actual value(s) that the phase scrambler 66 associates with each carrier signal can be derived from one or more predefined parameters, such as a pseudo-random number generator (pseudo-RNG)." *Id.*, 4:57-60, FIG. 1. Thus, a POSITA would have understood that Tzannes's phase randomizer (see FIG. 1 below) performs a predetermined transformation. DISH-1004, ¶251.

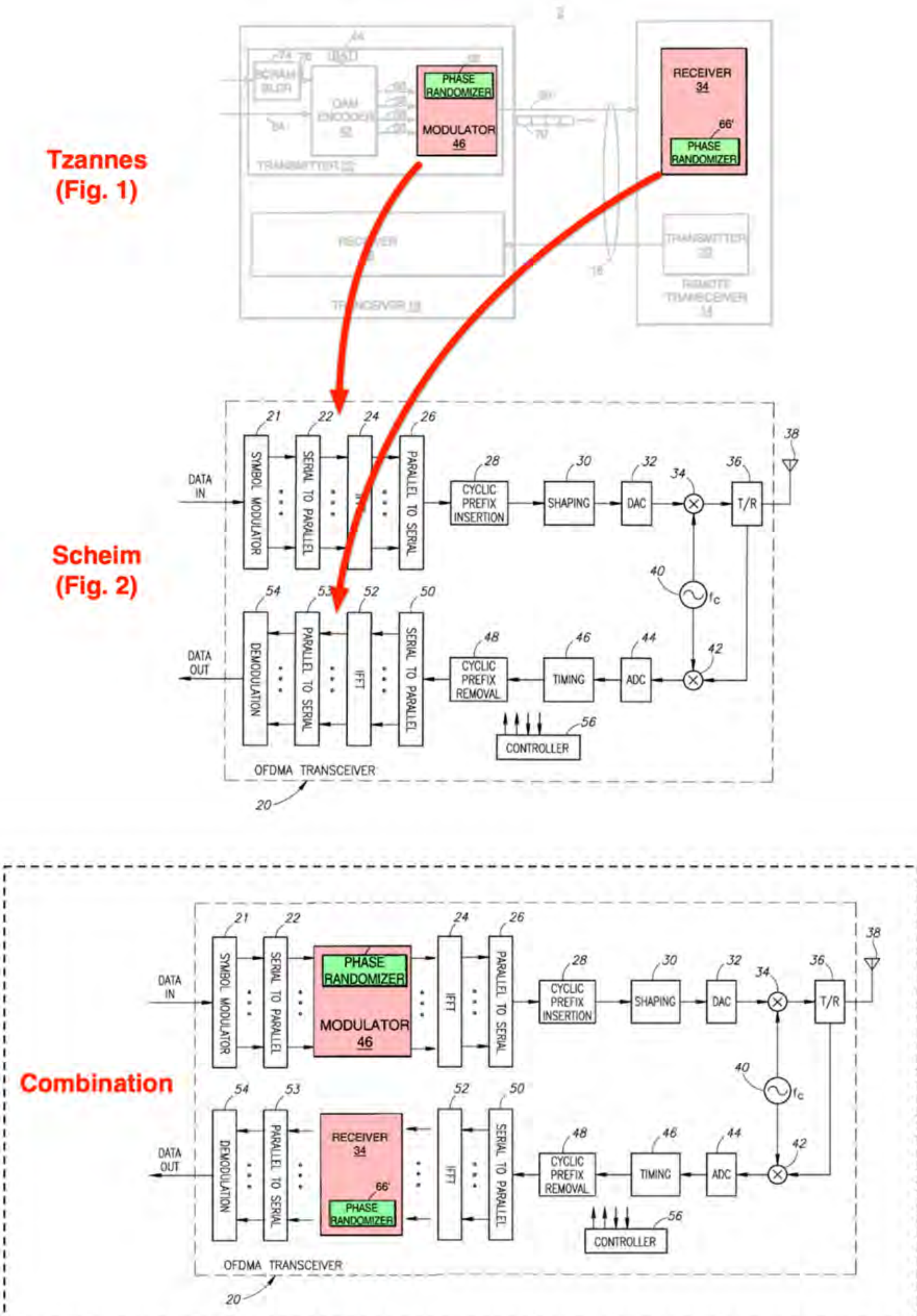


TZANNES, FIG. 1

Tzannes further discloses that "the remote receiver 34 similarly derives the value from the same pseudo-RNG and the same seed as used by the transmitter (i.e., the transmitter pseudo RNG produces the same series of random numbers as the receiver pseudo-RNG)." DISH-1009, 5:32-36, FIG. 1. Thus, a POSITA would have understood that Tzannes's disclosure of a receiver that stores data corresponding to the transmitted PN sequence means that the pseudorandom noise sequence corresponds to the used subcarrier. DISH-1004, ¶252.

Further, as explained in §IV.E.3 and §IV.E.4[1b], a POSITA would have understood that applying Tzannes's techniques to Scheim would require the simple

insertion of a Tzannes's phase scrambler fit between Scheim's serial-to-parallel block and its IFFT block, as shown below:



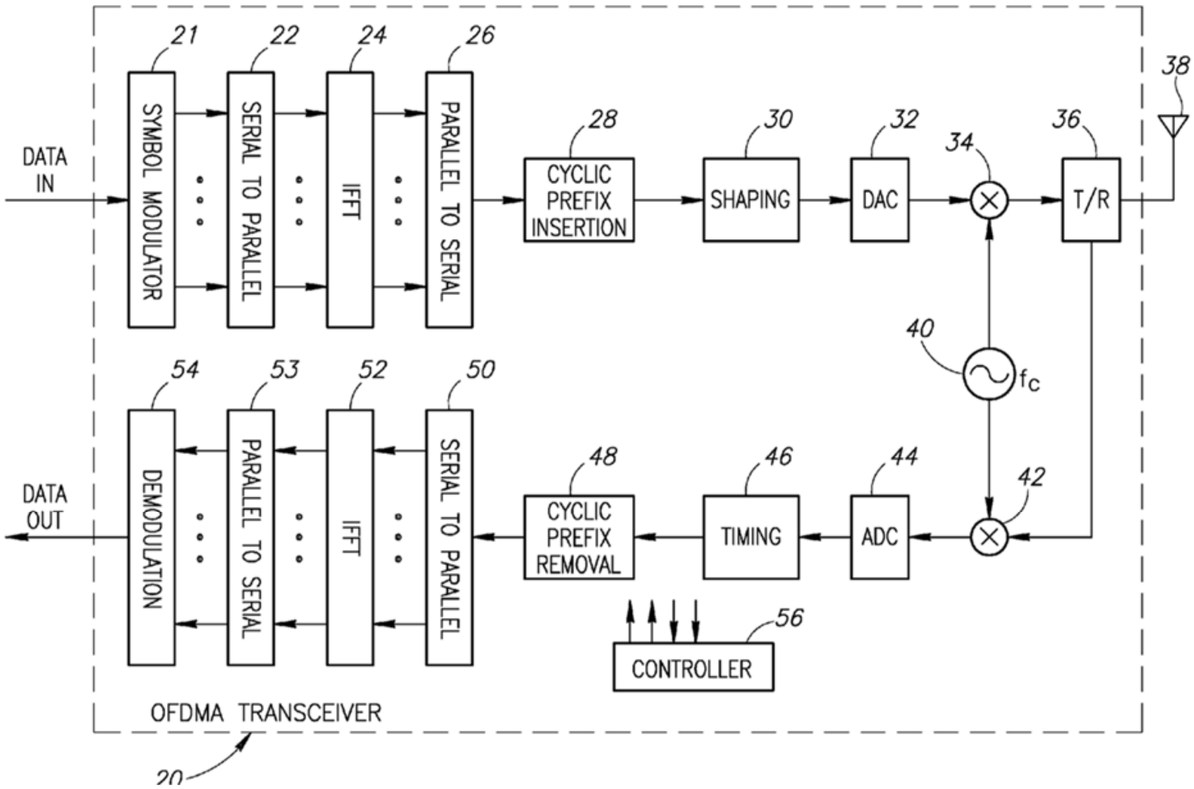
TZANNES, FIG. 1; SCHEIM, FIG. 2; COMBINATION

DISH-1004, ¶253. A POSITA would have understood that in Scheim-Tzannes, Tzannes's phase randomizer performs the predetermined transformation on the QAM symbols that come from Scheim's symbol modulator 21 (via serial-to-parallel block 22). *Id.*, ¶254. With this modification, Scheim would realize Tzannes's benefits of reducing PAR. *Id.*

[1f] "f) the transmitting network device transmitting the transformed symbol to a receiving network device."

A POSITA would have understood that an OFDMA network device transmits a signal that has been processed. DISH-1004, ¶256.

Additionally, Scheim discloses transmitters that transmit modulated data symbols and demodulate those symbols at receivers. DISH-1017, ¶¶18, 137; DISH-1004, ¶257.



SCHEIM, FIG. 2 (PRIOR ART)

Tzannes similarly discloses a transmitter that transmits transformed symbols. DISH-1009, 3:24-28, FIG. 1; DISH-1004, ¶258. Thus, Scheim-Tzannes renders obvious one of Scheim's transmitters transmitting the transformed symbol to a receiver. DISH-1004, ¶259.

5. Claim 2

[2pre] "The method of claim 1, wherein the steps of providing a corresponding element of a pseudorandom noise sequence and performing a predetermined transformation comprise:"

To the extent limiting, Scheim-Tzannes teaches [2pre] for the reasons discussed in this Ground 2, particularly elements [1b], [1e], [2a], and [2b], which are incorporated herein. DISH-1004, ¶260.

[2a] "a) the transmitting network device [i] receiving an initial pseudorandom noise sequence element from a pseudorandom noise sequence generator, [ii] the initial pseudorandom noise sequence element corresponding to a first available subcarrier and [iii] transforming the symbol to be transmitted on the first available subcarrier if the first available subcarrier is a used subcarrier; and"

As discussed in Ground 2, element [1e], a POSITA would have understood that when Tzannes's PN sequence elements are used to modulate particular data symbols, they correspond to the used subcarrier. DISH-1004, ¶¶261-262; DISH-1009, 4:33-67, 6:1-18 (explaining "the pseudo-RNG generates a new random value for each carrier signal"), 6:22-23, FIGS. 1, 2. Tzannes also discloses that each unique random value is used to transform a corresponding used subcarrier (e.g., the initial pseudorandom noise sequence element corresponding to a first available subcarrier and transforming the symbol to be transmitted on the first available subcarrier). DISH-1009, 7:50-8:8; DISH-1004, ¶263.[24]

[2b] "b) the transmitting network device advancing the pseudorandom noise generator to receive a next element of the pseudorandom noise sequence corresponding to a next available subcarrier and transforming the symbol to be transmitted on the next available subcarrier if the next available subcarrier is a used subcarrier."

---

[24] Scheim describes how a pseudo-random number generator (pseudo-RNG), like the one used in Tzannes, works. *See* DISH-1017, ¶¶111-113; DISH-1004, ¶263.

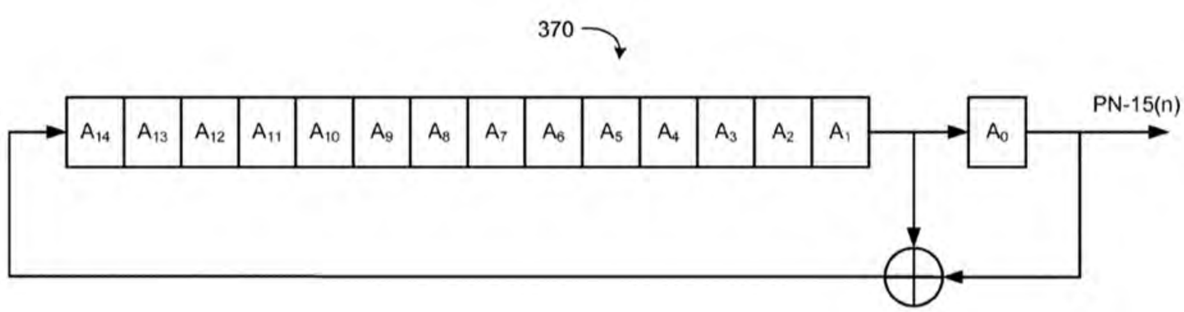
As discussed in this Ground 2, particularly elements [1e] and [2a], incorporated herein, Scheim and Tzannes disclose using PN sequence elements that correspond to used subcarriers, and that the PN sequences advance to generate a next unique random value (i.e., element) for the next available subcarrier. DISH-1004, ¶¶264-265.

6. Claim 3

[3] "The method of claim 2, wherein the step of the transmitting network device advancing the pseudorandom noise generator is repeated until a symbol to be transmitted on a last used subcarrier is transformed."

A POSITA would be aware of many methods to generate PN sequences. DISH-1004, ¶¶266-267.

Figure 11 of the '566 patent describes one method, which employs "shift register 370" such that "[w]hen the sequence generator is clocked, the shift register generates a new A_{14} as A_0+A_1, discards the bit in A_0, movies [sic] each bit from A_n to A_{n-1}." DISH-1001, 8:55-9:9, FIG. 11; DISH-1004, ¶268.



'566 Patent, FIG. 11

As Dr. Williams explains, a POSITA would have recognized the figure depicts a linear feedback shift register and that using shift registers to generate and advance PN series noise sequences was well known. DISH-1004, ¶269. For example, Mutagi discloses the use of "[p]seudo random binary sequences (PRBSs), also known as pseudo noise (PN) [or] linear feedback shift register (LFSR) sequences" in OFDM communications. DISH-1014, 79-80. Similarly, Gupta and Vijayan disclose OFDM communication systems that utilize "PN generator 1620 … with a 15-tap linear feedback shift register (LFSR)." DISH-1012, 17:17-20 (quoted); DISH-1013, 7:21-23 (disclosing a LFSR with 15th order polynomial); DISH-1004, ¶270.

As discussed in this Ground 2, particularly elements [1b], [1e], [2a], and [2b], Tzannes discloses advancing a pseudorandom noise generator in teaching that "[t]o compute a phase shift for each carrier signal, … phase scrambler 66 determines each value for a carrier signal independently of the QAM symbols 58, and, therefore, independently of the bit value(s) modulated onto the carrier signal." DISH-1009, 4:52-67; DISH-1004, ¶271.

Further, a POSITA would have understood that Tzannes's phase scrambler would work with a LFSR. DISH-1004, ¶272; DISH-1009, 4:42-48. Additionally, a POSITA would have understood that Tzannes's PN sequences are advanced until a symbol to be transmitted on a last used subcarrier is transformed. DISH-1004,

¶272; DISH-1009 4:54-55 ("The phase scrambler 66 determines each value for a carrier signal independently of the QAM symbols 58.").

F. GROUND 2B: Scheim-Tzannes, in view of Mutagi, renders claim 4 obvious

1. Scheim-Tzannes in view of Mutagi

As discussed above in Ground 1B, Mutagi demonstrates that PN sequences were well known in digital communications. *See* §IV.B. That discussion applies equally to Scheim-Tzannes because each reference (Cleveland, Hayashino, Scheim, and Tzannes) is directed to OFDM/OFDMA. DISH-1004, ¶273.

2. Claim 4

[4] "The method of claim 1, wherein the pseudorandom noise sequence comprises a PN-15 sequence."

Scheim-Tzannes, coupled with a POSITA's knowledge as Mutagi reflects, renders obvious claim 4. DISH-1004, ¶274.

As shown above, Tzannes's scrambler generates a pseudorandom sequence. DISH-1004, ¶275; DISH-1009, 4:52-67, 6:13-28. Mutagi discloses 24 PN sequences, and it specifically discloses "a 15 bit PN sequence" throughout its discussion. DISH-1014, 80, FIG. 1. Because Mutagi discloses many PN sequences including a PN-15 sequence, and because a POSITA would have found it obvious to try using any of those sequences, a POSITA would have found claim 4 obvious.

G. GROUND 2C: Scheim-Tzannes, in view of Mutagi and Ting, render claim 5 obvious

1. Scheim-Tzannes in view of Mutagi and Ting

As discussed above in Ground 1, a POSITA would have been motivated to increase the randomization in pilot signals in Scheim-Tzannes-Mutagi's network to decrease further the potential interference in the network. *See* §IV.C. (incorporated herein); DISH-1004, ¶276. Further, pilot signals are critically important to system operation because they are used to establish a link between a transmitter and receiver, as well as to synchronize the transmitter and receiver. Given these functions, a POSITA would have been motivated to ensure that the pilot signal is not lost due to interreference. To address this problem, a POSITA would have been motivated to use an approach like Ting's, which helps ensure that network devices receive the appropriate pilot signals. Thus, applying Ting's teachings improves Scheim-Tzannes regarding pilot signals. DISH-1004, ¶277.

2. Claim 5

[5] "The method of claim 4, wherein the step of performing the predetermined transformation comprises rotating the quadrature amplitude modulated symbol by 180° if the element of the pseudorandom noise sequence is a '1' and not modifying the quadrature amplitude modulated symbol if the element of the pseudorandom noise sequence is a '0'."

Ting teaches multiplying pilot symbols by this factor:

$$2 \times (\frac{1}{2} - W_k)$$

DISH-1015, 23-24; DISH-1004, ¶¶278-279. As a POSITA would have understood, when a bit stream is multiplied by Ting's factor, the resultant product rotates a "1" to a "-1" and a "0" to a "1", which rotates the symbol (on a QAM constellation) by 180°. DISH-1004, ¶280.

H. GROUND 2D: Scheim-Tzannes, in view of Mutagi and Ohana, Render Claims 6 and 12 Obvious

1. Scheim-Tzannes in view of Mutagi and Ohana

As shown in Ground 1D, a POSITA would have understood that Ohana discloses known components in a coordinated network—i.e., network coordinators and reservation requests. *See* §IV.D; DISH-1004, ¶¶281, 212.

In the 2000's, wireless customers were demanding increased data speeds. DISH-1004, ¶282; DISH-1008, 10 ("The demand for high data rate wireless multi-media applications has increased significantly in the past few years."). A POSITA looking to increase data speeds on Scheim-Tzannes's network would have been motivated to use Ohana's persistent reservation requests because they reduce reservation-request latency. DISH-1016, ¶¶13, 15, 29; DISH-1004, ¶283. Further, a POSITA would have had a reasonable expectation of success in using Ohana's persistent reservation requests in Scheim-Tzannes, because implementing the p-RR's would have been an exercise of ordinary skill. DISH-1004, ¶283.

2. Claim 6

[6] "The method of claim 4, wherein the receiving network device comprises a network coordinator and wherein the packet comprises a resource reservation request packet."

As discussed, Ohana discloses the subject matter of claim 6, namely a network coordinator and a packet that is a resource-reservation request. DISH-1016, ¶41, FIG. 4; DISH-1004, ¶¶284-286. Ohana's network uses persistent reservation requests ("p-RR") that "request allocation of network resources for transmitting the data. DISH-1016, ¶¶29-30.

3. Claim 12

[12] "The method of claim 4, wherein the method is performed by a network coordinator and wherein first and second scrambled orthogonal frequency division modulation symbols are contained in a resource reservation request packet.

Scheim-Tzannes renders claim 12 obvious based on the rationale presented under claims 1, 4, and 6, incorporated herein. DISH-1004, ¶¶287-288.

Furthermore, a POSITA would have found it obvious to include a scrambled OFDMA symbol in a resource reservation request packet because multiplexed networks, like OFDM/OFDMA and ADSL, typically deliver reservation requests over multiple subchannels, which requires using at least two scrambled OFDM symbols. DISH-1004, ¶288; DISH-1016, ¶8. Additionally, including the scrambled OFDMA symbol in a resource reservation request lowers PAR across the network. DISH-1004, ¶288. Thus, a POSITA would have been motivated to

use Scheim-Tzannes's approach in reservation requests, to realize Scheim-Tzannes's benefits across the network's entire operation. *Id.*

V. DISCRETIONARY DENIAL IS UNWARRANTED

A. The *Fintiv* Factors Favor Institution

Institution is consistent with the Director's guidance on applying *Fintiv*. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential); *Memorandum: Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation* (June 21, 2022) ("*Director's Guidance*"). A holistic analysis of the *Fintiv* framework favors institution.

1. Factor 1: Institution Supports Stays in Parallel Proceedings

Should the Board institute this proceeding, DISH will move to stay the District Court case, which will likely be granted. *CAO Lighting, Inc. v. Signify N. Am. Corp.*, No. CV 21-08972-AB (SP), 2022 WL 20563918, at *2 (C.D. Cal. Dec. 21, 2022) (recognizing "near uniform line of authority reflecting the principal that after the PTAB has instituted review proceedings, the parallel district court litigation ordinarily should be stayed"). Institution and stay of the several litigations asserting the '566 patent would enable the Board to resolve the '566 patent's validity, and relieve the District Court of the need to continue with the companion litigation for this patent. This opportunity for simplification increases

the likelihood that the court will grant a stay in view of IPR institution. *C.R. Laurence Co. v. Frameless Hardware Co.*, 2:21-cv-01334-JWH-RAO (CDCA, December 9, 2022); *Guy A. Shaked Investments, Ltd. v. Trade Box, LLC*, 2:19-cv-10593-AB-MAA (CDCA, November 18, 2020); *Masimo Corp. v. Apple Inc., 8:20-cv-00048-JVS-JDE* (CDCA, October 13, 2020) (all granting motions to stay pending IPRs).

2. Factor 2: The Board's Final Written Decision Will Likely Issue in Advance of Any Foreseeable Trial

The District Court case was filed on February 10, 2023, but due to multiple motions to dismiss, DISH filed its Answer on September 21, 2023. The trial date has not been set. Over all civil cases, the last-reported median time to trial in CDCA was 28.4 months. DISH-1019 (median time to trial in CDCA is 28.4 months). However, the median time to trial for CDCA patent cases in 2023 is **34.4 months**. DISH-1020. The anticipated August 2025 Final Written Decision ("FWD") would likely be before a median time-estimated trial date in December 2025 (based on 34 months).

Moreover, the Court set the Claim Construction Hearing for September 17, 2024. DISH-1021. The case likely will not be ready for trial before a August 2025 FWD, given that multiple key milestones must be completed in the nine months following claim construction, including close of fact discovery, expert discovery,

dispositive motions. Regardless, because this filing precedes a trial-scheduling order, the District Court may set its schedule to ensure trial follows a FWD.

In sum, the uncertainty of a trial date and the strong likelihood that the FWD will issue before trial weigh in favor of institution. And, even if not, "the proximity to trial should not alone outweigh" other relevant factors. *Director's Guidance*, 8.

3. Factor 3: DISH's Diligence Outweighs the Parties' Investment in the Litigation

The District Court proceeding is in its early states, and the parties' and court's investment has been minimal. Indeed, as discussed, the Court has not issued a full schedule, and claim construction briefing is six months away. DISH-1021.

PO asserted twelve patents in its Complaint. Ten remain after the Court found two patents ineligible. Further, PO just recently served infringement contentions (September 29, 2023), which first disclosed the full list of asserted claims. Despite this volume and late notice of asserted claims, DISH diligently prepared multiple IPR petitions and is filing them earlier than the one-year statutory bar date.

DISH's substantial investment in its IPR petitions outweighs the minimal resources invested in the co-pending litigation. The minimal resources expended

in district court have been borne equally by both parties, unlike the significant resources expended by DISH to prepare its petitions—effort that would be irretrievably lost without consideration of these petitions on the merits, in addition to the extensive expenses DISH will accrue in the remaining portion of the co-pending litigation.

In sum, this Petition was filed before the one-year statutory bar date and well before any party has made a substantial investment in the district court litigation. *Mylan Pharms. Inc. v. Sanofi-Aventis Deutschland GmbH*, IPR2018-01680, Paper 22 at 18 (PTAB Apr. 3, 2019) (finding that petition filed two months before bar date is "well within the timeframe allowed by statute, weighing heavily in [DISH's] favor"). DISH's diligence in filing this Petition shortly after receiving PO's initial infringement contentions and at an early stage of the companion litigation favors institution. *See Apple Inc. v. Seven Networks LLC*, IPR2020-00156, Paper 10 at 11-12 (PTAB Jun. 15, 2020) (finding factor 3 in Petitioner's favor where "Petitioner did not wait until the eve of the statutory bar date to file the Petition"); *Sotera Wireless, Inc. v. Masimo Corp.*, Paper 12 at 16-17 (PTAB Dec. 1, 2020) (comparing investment in district court case with IPR petitions to find factor 3 in Petitioner's favor).

4. Factor 4: The Petition Raises Unique Issues

DISH asks the Board to consider the unique challenges raised in the Petition.

See Fintiv, 12-13. If the Board institutes the pending Petition, DISH will not pursue district-court invalidity challenges based on the same grounds in this petition pursuant to 35 U.S.C. §315(e), thereby eliminating any risk of duplicated effort between the litigation and the IPR.

5. Factor 5: DISH's Involvement in Parallel Proceedings

The parties are the same in this IPR and in the parallel District Court proceeding.

6. Factor 6: The Merits Support Institution

As *Fintiv* noted, "the factors … are part of a balanced assessment of all the relevant circumstances in the case," and, "if the merits of a ground raised in the petition seem particularly strong … [instituting IPR] may serve the interest of overall system efficiency and integrity…." *Fintiv*, 14-15. As explained in the Petition (with expert testimony from Dr. Williams), the grounds raised herein are strong, and institution would result in invalidation of the Challenged Claims.

B. *Advanced Bionics* Favors Institution

Advanced Bionics strongly favors institution. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020) (precedential).

This Petition's prior art references were not considered or cited in the prosecution of the '566 patent, and the principal references presented are

materially different from those the Examiner relied upon. *See generally* DISH-1005; DISH-1001. Additionally, the Office address did not address through substantially similar prior art, the obviousness combinations this Petition presents. Thus, this Petition does not involve the same or substantially the same prior art or arguments previously presented to the Office. The Grounds above demonstrate why further consideration is warranted.

VI. CONCLUSION

DISH respectfully requests the Board institute IPR and cancel the Challenged Claims.

VII. FEES

Please apply any fees to Deposit Account No. 06-1050.

VIII. MANDATORY NOTICES

A. Real Party-In-Interest

DISH Network L.L.C. is petitioner and real party-in-interest. DISH Network Corporation, Dish Network Service L.L.C., and Dish Network California Service Corporation are additional real parties-in-interest. No other party had access to or control over the filing of this Petition, and DISH did not file this Petition for the benefit of any other party or entity.

B. Related Matters

DISH is not aware of any disclaimers, reexamination certificates, or petitions for *Inter Partes* Review for the ’566 patent.

DISH is aware of the following civil actions involving the subject matter of the ’566 patent.

Case Number	Filing Date
Entropic Communications, LLC v. DirecTV, LLC f/k/a DirecTV, Inc. et al., 2-23-cv-05253 (CDCA)	July 1, 2023
Entropic Communications, LLC v. DISH Network Corporation et al., 2-23-cv-01043 (CDCA)	February 10, 2023
Entropic Communications, LLC v. Cox Communications, Inc. et al., 2-23-cv-01047 (CDCA)	February 10, 2023
Entropic Communications, LLC v. Comcast Corporation et al., 2-23-cv-01048 (CDCA)	February 10, 2023
Entropic Communications, LLC v. Charter Communications, Inc., 2-23-cv-00050 (EDTX)	February 10, 2023
Entropic Communications, Inc. v. ViXS Systems, Inc. et al., 3-13-cv-01102 (SDCA)	May 8, 2013

C. Lead And Back-Up Counsel

DISH designates the following counsel:

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D. Service Information

Please address all correspondence and service to the address listed above.

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Respectfully submitted,

Dated: February 8, 2024

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CERTIFICATION UNDER 37 C.F.R. §42.24

Under the provisions of 37 C.F.R. §42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter partes* Review totals 13,879 words, which is less than the 14,000 allowed under 37 C.F.R. §42.24.

Dated: February 8, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on February 8, 2024, a complete and entire copy of this Petition for *Inter partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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